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A Mixed Methods Approach to Investigating Adjourning Phase Behavior in a Sample of the Product Development Teams in the Light Metal Forming Industry

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by

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Abstract

Title: A Mixed Methods Approach to Investigating Adjourning Phase Behavior in a Sample of the Product Development Teams in the Light Metal Forming Industry.

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This study aimed to integrate existing literature, research, and thinking about team interactions during and after significant events like joint ventures, mergers, or technological changes exhibiting adjourning-like conditions in the team development process. The study of the product development teams representing the light metal forming industry followed the mixed-methods sequential design, including the Straussian approach to grounded theory during the qualitative phase of the study. The quantitative phase of the study included the creation of the Team Interactions Scale, followed by the Exploratory Factor Analysis.

Successful verification of the proposed framework stimulated the introduction of the Team Interactions Score, capable of charting the product development trajectory between two significant events. Moreover, the discussion of the Team Interaction Score characteristics enabled the idea of the Dendritic Branching as a potential mechanism for late-stage team development. The speculative CONE principle is the last element introduced during this

exploratory study of product development team members' behavior during and after significant events.

The new perspective proposes that the Team Interactions Score before and after the significant event are different and that the potential team development trajectories could also change after the significant event. Such a perspective on team development is not present in the literature available for review. It is also conceivable that the flexibility built into the dendritic branching perspective of team development will enable other researchers to explore other applications for the ideas proposed in this study.

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Introduction

Overview

New product launches could account for about 30% of corporate sales in leading companies, and there is a strong connection between successful product development and business valuation (R. Cooper, Edgett, & Kleinschmidt, 1998). In other words, product development is essential to corporate growth (R. Cooper, 2017; R. Cooper & Kleinschmidt, 2007; Wong & Tong, 2012). When thinking about a new product, some people think about technology – smartphone, e-reader, Twitter, electric cars, and the like; however, most new products are far more prosaic – new movies, new fast food, and applications for teleconferencing or similar innovations exploiting the change or opportunity (Drucker, 1985, p. 35). In this study, the new products are products new to the company, new to the market, or both (Crawford & Di Benedetti, 2008, p. 12-14).

One of the focal points of this research was an exploration of how the product development team members could change their behavior under specific circumstances like joint venture, merger, acquisition, or a significant technological change. Several product development professionals provided an insight into product development team performance during times of significant change. They supported the creation of an instrument capable of detecting the level of some behavioral change exhibited by the product development practitioners during the joint venture, merger, acquisition, or similar significant events.

Light Metal Industry

This study targeted the product development teams in the light metal forming industry (code 331318 in the North American Industry Classification System released in 2017). The term "light metals" traditionally means Aluminum and Magnesium alloys because they are frequently used to reduce components and structures' weight (Polmear, 1995). Figure 1 lists some of the external drivers for Aluminum manufacturing in the US, including but not limited to the global price of Aluminum, the value of private nonresidential construction, industrial production index, new cars sales, and trade-weighted index (Pearce, 2004).

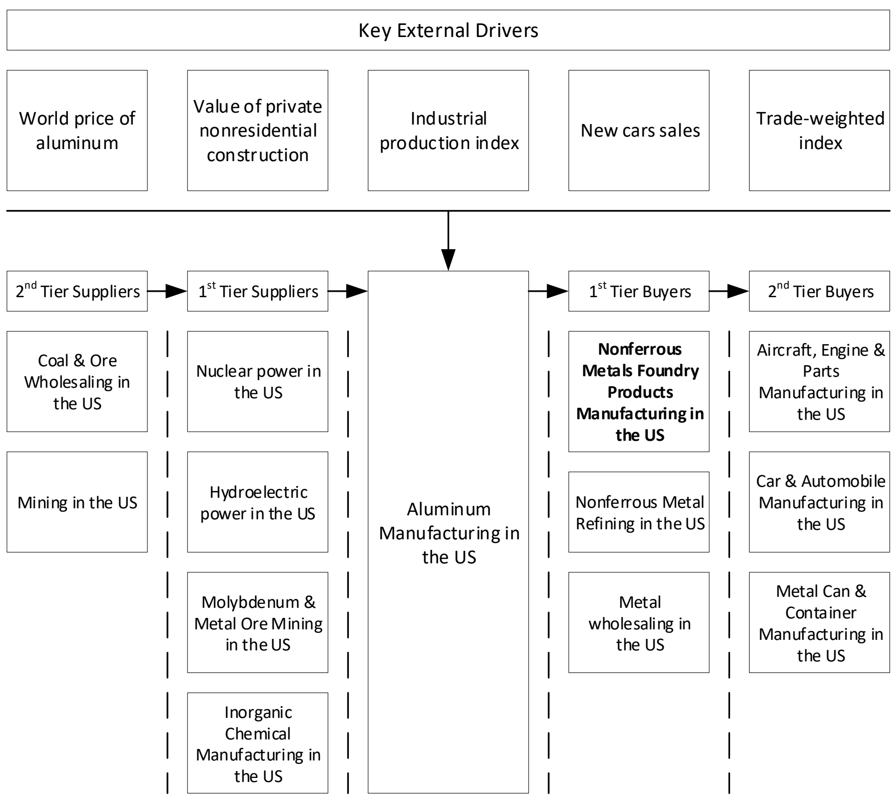

Figure 1 Some of the key external drivers of the Aluminum manufacturing industry in the US (Egan, 2021)

The light metal industry faces numerous challenges that will require innovative solutions. The energy intensity of metallurgical alumina production impacts the cost of primary Aluminum. Between 2001 and 2015, the prime Aluminum producers in North America were using less energy per ton of alumina than the rest of the world. Aluminum production used 3.5% of global electricity and caused 1% of global CO_2 emissions (Cullen & Allwood, 2013). The Aluminum industry faces a challenge in halving greenhouse gas emissions by 2050 (Haraldsson & Johansson, 2018) and must implement energy-efficient technologies (Rissman et al., 2020).

In the light metal forming industry, a new product could be a new alloy's chemical composition that uses a specific amount of recycled material to reduce CO_2 emissions. Designing, testing, and scaling up the new technology to deliver a new alloy with a reduced CO_2 footprint is a long-term project, running for many years. Moreover, the successful introduction of the new product requires significant support from several teams, including the product development team. Often, the product development team members stay with the project for many years (French, 1967; Whyte, 1956) and, due to the nature of the light metal forming industry discussed later in this chapter, most likely are influenced by the circumstances typical for significant events like joint ventures, mergers, and acquisitions.

In other words, the product or process development teams representing the light metal forming industry in the USA are very suitable for exploring the individual team member's behavioral change during times of significant change.

Dynamics of the Light Metal Industry

Since the early 1960s, the light metal industry has seen numerous vertical integrations and joint ventures (Mason, 1972; Schaffer, 2000; Stuckey, 1983; Teece, 1984). Stuckey (1983) analyzed the activities constituting the international Aluminum industry and concluded that integrated operation is far more critical in the Aluminum industry than in most other industries (p. 2). Stuckey (1983) also discussed the importance of know-how transfer in making joint ventures profitable (p. 166) and how the “own” know-how team can offer a superior service compared to the external know-how teams (p. 164). Teece (1984) presented a similar opinion on know-how transfer in the international aluminum industry (p. 1152). Finally, Stuckey (1983) notes that “as organizations grow, the individual’s sense of “belonging” and being “a part of the team” may decline, and performance along with it” (p. 135). This study explored the behavior of the product development practitioners and confirmed some of Stuckey’s observations about the individual's sense of belonging.

Schaffer (2000) used a New England Aluminum-processing company to illustrate the development of the management’s capabilities during the company’s radically accelerated growth and market penetration over five years using several strategic investments. Shaffer (2000, p. 374) described how the series of meetings between the management and the team of mill personnel cleared most of the misunderstandings and paved the way to achieving the desired and sustainable mill productivity increase without further capital investment. By combining forces, the management developed the capability to carry out increasingly ambitious aspects of the change by developing a coherent team.

Sigman (1991), in his essay describing selected features of the behavioral construction of long-term relationships, provides additional evidence and writes that during significant organizational change, the group members eventually "fold back into the organizational context to become members in other groups." One of the cornerstones of this exploratory study is the Substantive Theory of Monitoring Team Interactions, which uses "folding back into the organization" operationalized by the organizational commitment among the product development practitioners representing the light metal forming industry in the USA.

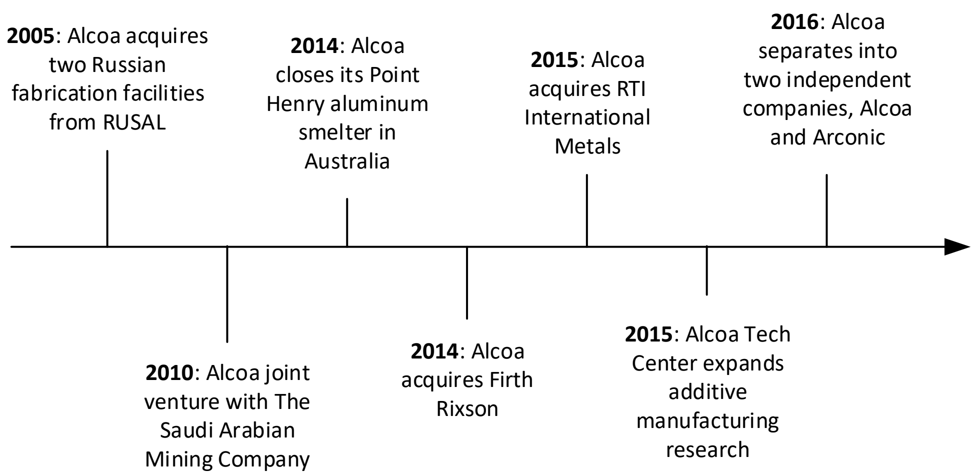

Figure 2 Alcoa – major acquisitions, closings, joint-ventures, and separations between 2005 and 2016

Alcoa Corporation is a vertically integrated Aluminum company comprised of bauxite mining, alumina refining, Aluminum production (smelting, casting, and rolling), and energy generation (*Alcoa Annual Report*, 2019). The Aluminum Corporation of America

(Alcoa), founded in 1888 in Pittsburgh, Pennsylvania, under the name The Pittsburg Reduction Company, commercialized the patented process of extracting Aluminum from bauxite ore by electrolysis (Brandt, 1990) and virtually created the market for Aluminum (D. S. Smith, 1988). In 1945, an appeals court ruling found Alcoa guilty of antitrust violations (Adams, 1951). In the following years, Alcoa went through a few diversification and acquisition phases, as presented in Figure 2. It is important to note that during the significant acquisitions, closings, joint ventures, and separations between 2005 and 2016, Alcoa's Tech Center remained in Pittsburgh, Pennsylvania, possibly impacting the expected performance of product development professionals and practitioners.

Based on the above summary, it is reasonable to assume that frequent mergers, expansions, and joint ventures significantly impact the product development team behavior, making the light metal industry very well suited and relevant for investigating the behavior in a product development team sample.

Background of the Study

One of the focal points of this research was a better understanding of the product development team's behavior under specific circumstances. The 1980s saw heightened interest in teams embedded in public and private production and service organizations (Ilgen, 1999). In the 1990s, the domestic popular business press included countless articles about the increasing role of teams in corporate America (Kochan, Barley, & Mavor, 1999, p.83). The significant interest in teams paved the way for research on teamwork, including various studies on product development teams. Sethi et al. (2001) studied domestic cross-functional product development teams with relatively stable and mature consumer products in various industries concluding that the product development process in these industries follows well-understood steps, leading to increased social cohesion among team members. The authors postulated that increased team cohesion could weaken team innovativeness over time (Sethi, Smith, & Whan Park, 2001). Studying the potential impact of time on various team members' behavior is one of the keys to unlocking our understanding of possible variations in team members' behavior. This exploratory study proposed the Team Interactions Score to determine the link between the potential team development trajectory and the time elapsed since a significant event like joint ventures, mergers, or acquisitions. Chapter 5 of this study includes an in-depth discussion of the Team Interactions Score established for the product development teams that participated in this study.

Product Development Team

Despite a high number of publications on teamwork discussing the creation of high performing organizations (Hackman, 2002; Katzenbach & Smith, 1993), the changing nature of team performance (Ilgen, 1999; Ilgen & Pulakos, 1999), or implications for staffing, motivation, and development (Ilgen & Pulakos, 1999), relatively little information is available on the behavior of the members of a product development team (Ancona & Caldwell, 1992; Holland, Gaston, & Gomes, 2000; Jassowalia & Soshittal, 2002).

For example, the typical guide to new product development, like the PDMA Handbook of New Product development edited by Kahn (2012), covers almost all aspects of the product development process, discussing why new products win and new product success drivers. The following few chapters of the handbook cover tools and processes to direct the new product development. Case studies illustrate the use of tools, and the final chapters of the new product development handbook suggest how the company should create and implement a new product development strategy (Brethauer, 2002; R. Cooper, 2017). While these guides are a great source of information and best practices for conducting new product development, they seldom discuss the role of human creativity as an effectively managed process. The role of individuals in product development is not present in typical guides on product development. Even textbooks on product development published by the Product Development & Management Association (PDMA) do not explicitly discuss individuals' role in product development processes (Kahn, 2005; Leenders, Kratzer, Hollander, & van Engelen, 2002). The only person-related aspect of product development presented in these textbooks is managing product development teams and an overview of innovative approaches and organizational architecture in various organizations (Kahn, 2005, pp. 127–188).

The lack of information about the possible link between the product development team characteristics and their impact on its performance is not surprising. In other words, it should not come as a surprise that it is difficult to find information on the product development team dynamics if this topic is seldom the sole topic of research. Specifically, the group and organizational literature focus on the development and maintenance of groups and is likely to exclude the research on how these very same groups come to closure (Chan, 1998; Dyer & Ericksen, 2004; Kahn, 2005; Keyton, 1993; McCarthy, O'Raghallaigh, Fitzgerald, & Adam, 2021; McMorris, Gottlieb, & Sneden, 2005; Offermann & Spiros, 2001; Rickards & Moger, 2000).

Even the most adequately designed teams, including the product development teams, will not perform without proper management and coordination of their efforts (Hackman, 2002). High-performing teams are not enough to create high overall product development results (Belliveau, Griffin, & Somermeyer, 2002). However, good teams are a precondition, both directly and indirectly, to the success of product development efforts (Sivasubramaniam, Liebowitz, & Lackman, 2012).

Team Development

The temporal unfolding during a team's evolution is a central feature of developmental models (Kozlowski, Gully, Nason, & Smith, 1999). Product development teams, like other teams, require time to mature. They form, establish regulatory mechanisms, and evolve through a series of recognizable changes (Kozlowski et al., 1999). There are many team development models available in the literature, and the two most prominent team development models are the punctuated equilibrium (Gersick, 1989, 1992) and five-stages team development (Tuckman, 1965; Tuckman & Jensen, 1977). Both models assume that the team or a group will form, complete the task or a similar function, and eventually, the team will dissolve. Tuckman and Jensen (1977) coined the phrase adjourning to describe the team members' interactions during the final stage of team development.

Since the beginning of the stage-based model development, researchers named the stages of team development differently (see Table 1 for more details). Moreover, the researchers proposed different items or team characteristics for each stage, including the adjourning stage. As a result of this situation, modern Organizational Behavior textbooks offer a variety of adjourning phase descriptions, as in the following examples:

> *Adjourning – in this stage, the group prepares for its disbandment. High task performance is no longer group's top priority. Instead, attention is directed toward wrapping up activities. Responses of group members vary in this stage. Some are upbeat … others may be depressed over the loss of camaraderie and friendship (Robbins & Judge, 2013, p. 222)*

> *Adjourning – the group's work is done; it is time to move on to other things. The return to independence can be eased by rituals such as parties and award ceremonies celebrating the need and new beginning (Kinicki & Fugate, 2018, p. 306)*

While this study does not seek a new definition of the adjourning phase, it does aim to integrate existing literature, research, and thinking about team behavior and its relationship to the product development team performance during the final stage of the team development by a mixed-methods investigation of the adjourning phase behavior in a sample of the product development teams and then proposing a method for detecting the team development stage. Unfortunately, the definitions of adjourning phase available in the literature are not coherent and lack information on how they were created (Kinicki & Fugate, 2018; Robbins & Judge, 2013). In one case, a researcher proposed an extension to Tuckman's theory and defined adjourning it in terms of compromise, communication, consensus, and closure (Maples, 1988). The first letter of the four characteristics used to describe the team behavior during the adjourning phase is not accidental. Maples' (1988) model of extended Tuckman's theory includes characteristics beginning with the same letter for each team development stage. Moreover, in 1996 Wheelan and Hochberger did not include any items for adjourning in their Group Development Questionnaire because "the termination phase of group development has insufficient empirical validation to be included in an instrument at this point of time" (p. 156). This study provided some impetus to close this gap by proposing the Substantive Theory of Team Interactions during the significant event, developing, and validating the Team Interactions Scale, and offering the Team Interactions Score as a tool for studying the potential team development trajectories after the significant events like joint ventures, mergers, acquisitions, or significant technological changes.

The rationale of the Study

The organizations in which people work have a significant impact on their thoughts, feelings, and actions in the workplace. Similarly, people's thoughts, feelings, and actions affect the organization in which they work (Brief & Weiss, 2002; Schneider, 1987). One of the deeply embedded ways of thinking about organizations is the open system perspective of organizations (J. D. Thompson, 1967). Figure 3 depicts an organization embedded within an external environment (McShane & Glinow, 2009, p. 6). Such an open system has a permeable relationship with the external environment.

Moreover, as an open system, the organization depends on the external environment for raw materials, employees, financial resources, information, and equipment (McShane & Glinow, 2009). The organization consists of numerous subsystems such as processes (communication), tasks (production, marketing), and social dynamics (groups and teams). The subsystems transform inputs into outputs. One of the potential outputs is a change in employee behavior. Therefore, it stands to reason that the change to the external environment, like a merger of two companies within the light metal industry, will impact some of the subsystems, like product development teams, in their respective organizations.

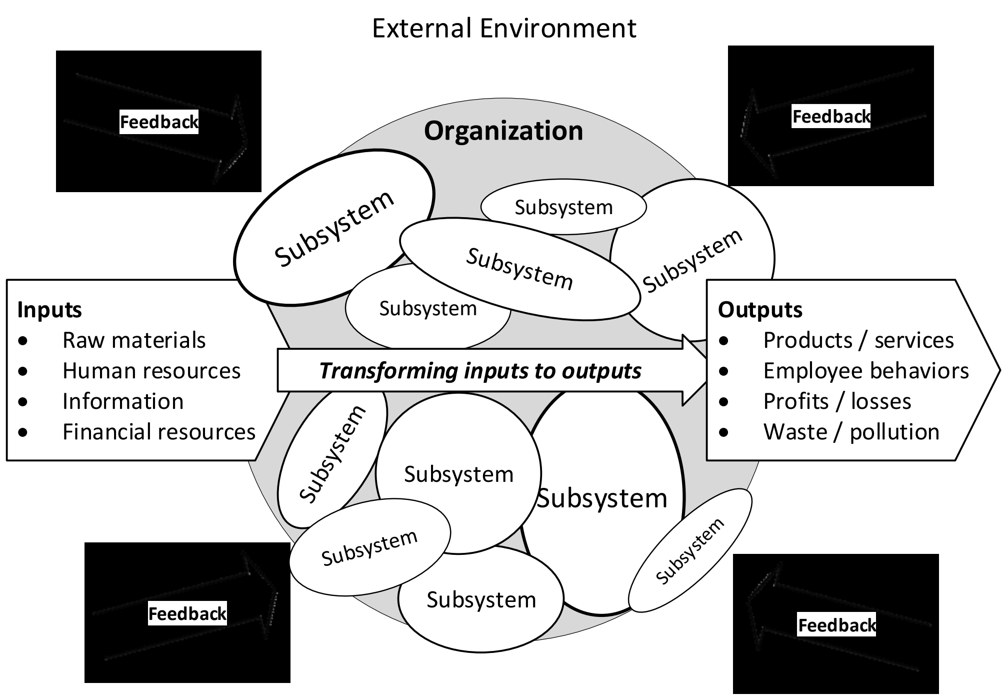

Figure 3 Open systems perspective of organizations (McShane & Glinow, 2009)

This study incorporated several theories, models, and perspectives from the field of Organizational Behavior. The Open System perspective by James D. Thompson (1967) served as a background perspective while exploring how the change to the external firm's environment could change the organization, specifically the outputs, including the employee behavior.

In the original paper on small-group development stages, Tuckman (1965) suggested the need for further research on natural and laboratory groups. In 1970, Whittaker included the separation stage in the stage-based model, and Yalom (1970) proposed the termination stage as an integral part of team development. Bruce Tuckman followed up on his advice and, in 1977, together with Mary Ann Jensen, published a revisited small-group development model. The 1977 models included the fifth stage of the team development process – adjourning. Tuckman's model offers a simple means of discussing and exploring team dynamics (Miller, 2003, p. 122) and has not diminished since the amended model's publication in 1977 (Bonebright, 2010, p. 119).

Creswell and Poth (2018) argued a correlation between appropriate research methodology, research questions, and the study goals. Given (2008) states that through qualitative research, the researcher can explore human elements of a given topic by using specific methods to examine how individuals see and experience the world. This study used a mixed-methods exploratory sequential research design to establish a set of characteristics of the adjourning-like phase behavior in a product development team sample. The mixed-methods exploratory sequential design is a three-phase design. The project begins with collecting and analyzing qualitative data, followed by the development phase focused on translating the qualitative findings into a tool appropriate for quantitative testing. Creswell and Plano Clark (2018, p.84) clearly state that by following the exploratory sequential design, *“the tool will be grounded in the views of participants”* and *“the quantitative feature is based on the culture or setting of participants rather than pulled “off the shelf” for use.”* When used to develop an instrument, this design is referred to as the instrument development design (Creswell, Fetters, & Ivankova, 2004; Enosh, Tzafrir, & Stolovy, 2015).

Statement of the Problem

The group and organizational literature have focused on the development and maintenance of groups while excluding the research on how these very same groups come to closure (Chan, 1998; Dyer & Ericksen, 2004; Kahn, 2005; Keyton, 1993; McCarthy et al., 2021; McMorris et al., 2005; Offermann & Spiros, 2001; Rickards & Moger, 2000). On the other hand, attitudes or values formed during the adjourning period are likely to influence organizational members when they take on new group assignments (Keyton, 1993; Sigman, 1991).

Measurement drives behavior and, even more importantly, behavior change (Morwitz & Fitzsimons, 2004; A. W. Pearson, Nixon, & Kerssens-Van Drongelen, 2000). Furthermore, it supports the prioritization of actions and enables comparing and tracking performance changes and differences.

Unfortunately, group development's adjourning phase has insufficient empirical validation for inclusion in any available instruments (McMorris et al., 2005; Miller, 2003; Wheelan & Hochberger, 1996). Just because a team is performing at a given point in time is no assurance that it will continue to do so (Kaeter, 1994). The practicing managers will need some guidelines on intervening when they observe the possibly negative change in the team's performance (Courtright, McCormick, Mistry, & Wang, 2017). A lack of a scientific description of the team development stage's potential impact on the product development team performance most likely prevents scientists from developing adequate team assessment tools and, as a result, managers from implementing them.

Purpose of the Study

This three-phase exploratory mixed-methods study aimed to capture participants' views to use this information to develop an instrument for assessing product development team members' behavior. Because there are no instruments to assess the adjourning-like phase behavior (Wheelan & Hochberger, 1996), an instrument needs to be developed based on participants' qualitative views. Statements and quotes from this qualitative data served as a base for an instrument capable of testing the substantive theory of Monitoring Team Interactions within a larger group of product development team members recruited from various firms within the metal forming industry.

Questions that Guide the Research

Research questions narrow the purpose statement into specific questions examined in this study. Mixed methods research questions, applicable in this study, are questions in a mixed-methods study that describe the integration of the qualitative and quantitative data (Creswell & Plano Clark, 2018, p. 165).

The following research questions guided this study:

1. What team member behavioral characteristics, derived from the interviews with product development professionals representing the light metal forming industry, change during Tuckman’s adjourning phase?
2. If the derived characteristic behavior’s change is present, how to determine the level of change?

Definition of Terms

Identifying and defining terms that readers will need to understand a proposed research project adds precision to a scientific study (Creswell, 2009, p. 40). The following list of specific terms includes definitions from various sources to bolster this mixed-methods approach to investigating the adjourning phase behavior in a sample of product development teams representing the light metal forming industry.

Adjourning – the adjourning phase of Tuckman's model indicates a point where the team terminates or is disbanded as they have completed their work and are no longer needed by the organization (Tuckman & Jensen, 1977). Other authors describe this phase as separation (Whittaker, 1970), order (Caple, 1978), and termination (Braaten, 1974; Lacoursiere, 1974).

Affective Organizational Commitment – individual's involvement and identification with the organization when individuals become intrinsically motivated or involved in the course of action that develops from an identification, association, and attachment with the larger organization's values and objectives (Kacmar, Carlson, & Brymer, 1999; Mercurio, 2015; Mowday, Steers, & Porter, 1979; Porter, Crampon, & Smith, 1972).

Grounded theory – The Grounded Theory Method comprises a systematic, inductive, and comparative approach for conducting an inquiry to construct theory (Bryant & Charmaz, 2007; Charmaz, 2014; Glaser & Strauss, 1967). The method requires researchers' constant interaction with their data while remaining involved with their emerging analyses. Data collection and analysis proceed simultaneously, and each informs and streamlines the other (Corbin & Strauss, 2015).

A joint venture – is a commercial enterprise undertaken jointly by two or more parties that otherwise retain their distinct identities (Stuckey, 1983).

Light Metal Forming Industry – industry devoted to primary production, secondary production, and semi-fabrication of light metals, specifically Aluminum, Titanium, Magnesium, Beryllium, and their alloys (Polmear, 1995).

Metal forming – in metal forming, the starting material has a relatively simple geometry that is plastically deformed in one or more operations into a product of relatively complex configuration (Altan, Oh, & Gegel, 1983, p. vii).

Merger – an agreement that unites two existing companies into one new company (Stuckey, 1983).

Mixed Methods Exploratory Sequential Design – the mixed-methods exploratory sequential design is a three-phase design. The project begins with collecting and analyzing qualitative data, followed by the development phase focused on translating the qualitative findings into a tool appropriate for quantitative testing (Creswell & Plano Clark, 2018; Creswell, Shope, Plano Clark, & Green, 2006).

New products – the new product are lines and additions to existing product lines (Crawford & Di Benedetti, 2008, p. 12-14).

Perceived Person-Team Fit – the perceived compatibility of individuals with the organizations or groups in which they work (Cable & Judge, 1997; N. Da Silva, Hutcheson, & Wahl, 2010; Elfenbein & O'Reilly III, 2007; Lovelace & Rosen, 1996)

Planned dissolution – takes place when the group accomplishes its goals and exhausts its time and resources (Forsyth, 2010, p. 132)

Product – anything referred to an external marketplace for sale, use, or consumption (Cooper, 2017, p. 25)

Product development team – a way to re-organize personnel involved in product development to facilitate informal communication, sharing of requirements, constraints, and ideas early in the product development cycle (Kahn, 2005)

Spontaneous dissolution – occurs when the group's end is not scheduled (Forsyth, 2010, p. 132)

Straussian approach to Grounded Theory – a systematic methodology applied to qualitative research proposed by Strauss (1987) and refined by Corbin and Strauss (1997, 2015). The methodology involves the construction of hypotheses and theories through the collecting and analysis of data (Corbin & Strauss, 2015; Strauss, 1987; Strauss & Corbin, 1997).

Team – a distinguishable set of two or more people who interact dynamically, interdependently, and adaptively towards a common goal and have been assigned specific roles or functions to perform (Swezy & Salas, 1992). In this study, the terms team and group are used interchangeably.

Team development – changes through time in the team's internal structures, processes, and culture (Sarri & Galinsky, 1974).

Tuckman's model – is the most prominent linear group (phase) development model (Offermann & Spiros, 2001). Tuckman's model includes four primary stages: forming, storming, norming, and performing (Tuckman, 1965). The updated model included the adjourning phase (Tuckman & Jensen, 1977).

Significance of the Study

Kerssens-van Drongelen and Cook (1997) proposed two clusters of performance management purposes – motivating people and diagnosing activities. The diagnostic approach could assess the effectiveness of some organizational changes (I. Kerssens-van Drongelen, 2001; I. C. Kerssens-van Drongelen & Bilderbeek, 1999; I. C. Kerssens-van Drongelen & Cook, 1997; A. W. Pearson et al., 2000). Schumann et al. (1995) add that *"measurement drives behavior and, even more importantly, behavior change."*

Keyton (1993) proposed a model of group termination to complete the study of group development. The model discusses both substantive and symbolic issues but does not provide any validation or a way to validate this proposal. Keyton did not publish any follow-up work on the group termination model.

In 1996, Wheelan and Hochberger presented the theoretical underpinnings, construction, and validation of an instrument designed to measure group development processes. The paper included a description of the adjourning phase. However, the 1996 version of the Group Development Questionnaire by Wheelan and Hochberger did not include any items for adjourning because *"the termination phase of group development has insufficient empirical validation to be included in an instrument at this point of time"* (p. 156). In 2003, Wheelan et al. presented a study on group development across time without mentioning the adjourning phase or including any items for adjourning in the 2003 version of the Group Development Questionnaire. The lack of sufficient empirical validation of the team behavior during the adjourning phase could prevent researchers from including it in their model and instruments.

This study closed some of this gap by adding initial empirical validation of the adjourning phase in Tuckman's model of group development to the body of knowledge in organizational behavior. Specifically, this researcher interviewed several product development professionals representing the light metal forming industry in the USA and asked them for their observations about the potential change in the product development team members' behavior during significant events like joint ventures, mergers, acquisitions, and technological change. The interviewees identified several behavioral characteristics that could change during the significant event, including, but not limited to, affective organizational commitment and perceived person-team fit. The team interactions surfaced as an intervening variable during the axial coding of the interviews. This researcher proposed and tested a new scale to evaluate team interactions. The results, grounded in the opinions of the product development professionals, paved the way to formulating the Substantive Theory of Monitoring Team Interactions reflecting reported behavior change among the product development team members during the significant extrinsic event.

This researcher extended the grounded results and proposed Team Interactions Score combining affective organizational commitment and perceived person-team fit into one index capable of producing the team development trajectory between two significant events. The introduction of the Team Interactions Score enabled this researcher to extend the original Tuckman's model (1964) beyond the performing stage while retaining adjourning as one of the possible team development outcomes. The possible team development outcomes, approximated by a speculative CONE principle, lead to the final proposition on the team development – the dendritic branching.

The dendritic branching is one of the most significant outcomes of this exploratory study. It allows for a new perspective on team development in organizations experiencing significant event discontinuities like joint ventures and mergers seen in the light metal forming industry in the USA. The new perspective proposes that the Team Interactions Score before and after the significant event are different and that the potential team development trajectories could also change after the significant event. Such a perspective on team development is not present in the literature available for review. It is also conceivable that the flexibility built into the dendritic branching perspective of team development will enable other researchers to explore other applications for the ideas proposed in this study.

Organization of the Remainder of the Study

Following the mixed methods approach to completing a study requires a sequential reporting of the methodological information. Furthermore, the Straussian approach to the grounded theory also impacts the sequence of the research steps. That is why Chapter 2 includes the preliminary literature review results focused on theories and models for product development. Additional literature reviews accompanied this study, and the literature review results accompany major milestones reported in this manuscript.

Chapter 3 introduces the mixed methods exploratory sequential design. A separate section explains the difference between Glaserian and Straussian approaches to the grounded theory and provides this researcher's perspective on completing the grounded theory study.

The second part of Chapter 3 covers data collection and data analysis. A dedicated section explains the initial and axial coding procedures essential to the Straussian approach. The final section of Chapter 5 covers the context linking action-interaction to the conditions in which it occurs. In this research, the context covers various aspects of the light metal industry in the USA, focusing on product development activities and product development team members. Presentation of context is an example of the methodological results not included in Chapter 4.

Chapter 4 begins with the results of coding of the interviews with the product development professionals representing the light metal forming industry in the USA. The subsequent discussion of the paradigm leads to the presentation of scales selected for this exploratory study. The results of the Exploratory Factor Analysis of the Teams Interactions Scale developed during this study are presented last.

Chapter 5 starts with the recap of results grounded in the observations as required by the Straussian approach to the grounded theory methods. The second part of Chapter 5 builds on the grounded results and offers the researcher's perspective on the substantive theory of Monitoring Team Interactions introduced in the previous chapter. The researcher's perspective presented in Chapter 5 includes an introduction of the Team Interactions Score, followed by the presentation of the Dendritic Branching idea, and finishes with the outline of the speculative CONE principle, potentially expanding Tuckman's model of group development. A brief discussion of limitations and practical applications accompany the researcher's recommendations for future research.

Chapter 2
Literature Review

Introduction

The systematic review is a fundamental scientific activity (Boote & Beile, 2005). It reduces the large quantity of information into digestible pieces (P. P. Morgan, 1986). It is essential to distinguish between the systematic review and the literature review. The systematic review uses a logical and complete plan to find and evaluate the literature on the stated topic and explains it clearly and in enough detail to allow others to carry out the same review (Fernandez, 2019). The literature review is a summary and evaluation of the relevant literature. The author followed the systematic review logic of available resources using the seven-step process recommended by Creswell (2009). These steps are (1) identification of the keywords, (2) initial search, (3) documentation of an initial set of research in articles or books, (4) brief evaluation of the usefulness of the initial set of research, (5) begin designing a literature map, (6) begin to draft summaries of the most relevant articles, and (7) assembly of the literature review by organizing it by essential concepts (Creswell 2009, p.29).

Figure 4 presents the literature search process followed in this study. It only represents the initial four steps of a systematic literature review proposed by Creswell (2009). Numerous strategies for conducting a systematic literature review are available to the researchers (Creswell & Zhang, 2009; Fernandez, 2019; Maxwell, 2006; Sekaran, 2003). One of the standard features of revised strategies for conducting a systematic literature search is the freedom of selecting the starting point. This researcher selected the Microsoft Academic Service as a starting point for the literature search summarized in this chapter (Harzing, 2017; Hug, Ochsner, & Brändle, 2016; Sinha et al., 2015; K. Wang, 2020) and Mendeley to index gathered papers and publications (Bandara, Furtmueller, Gorbacheva, Miskon, & Beekhuyzen, 2015; O'Neill, Booth, & Lamb, 2018).

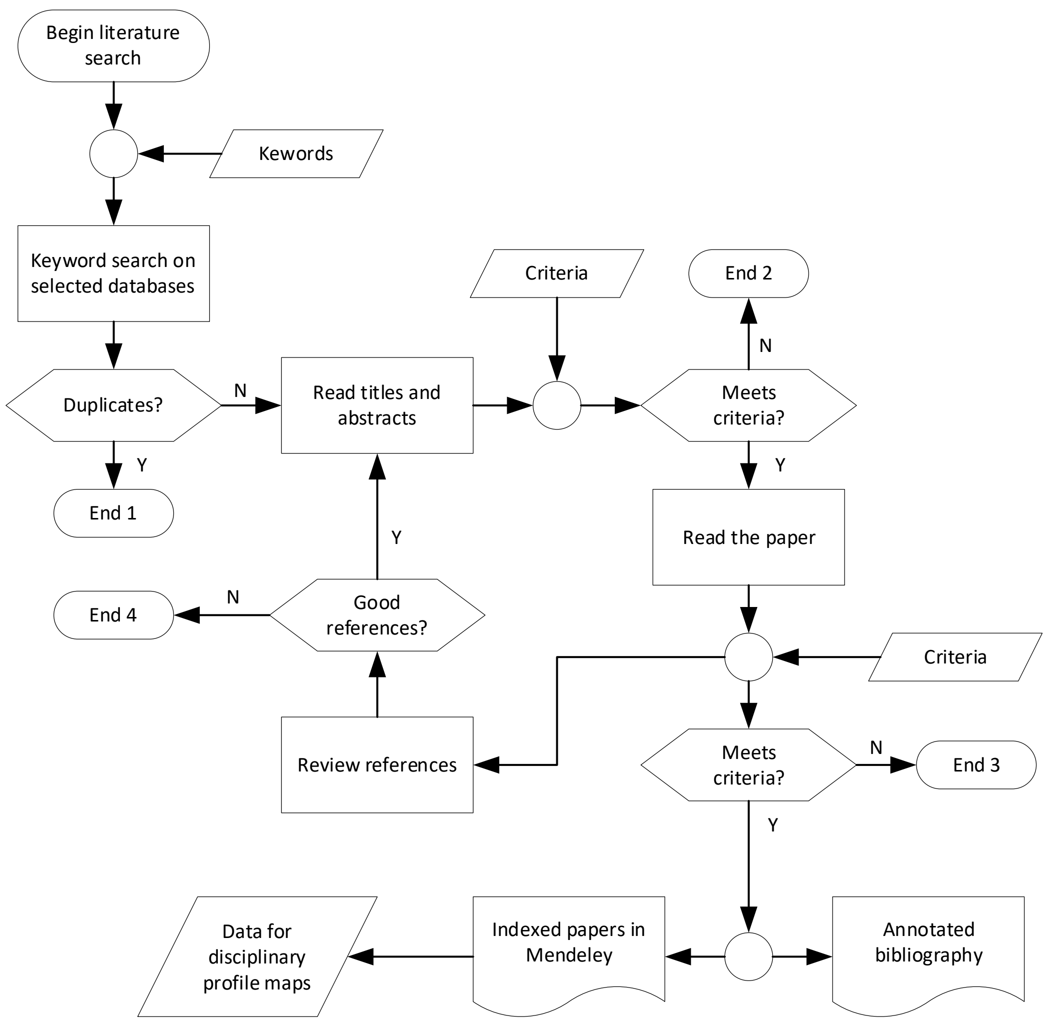

Figure 4 Flow chart of the literature search process completed for this study

Disciplinary profile maps

Designing the literature map is the fifth step in the seven-step systematic review process proposed by Creswell (2009, p. 33-35). This research builds on several studies focused on various aspects of the product development process that the author completed between 2019 and 2021. The study of strategy for product development provided the first insight into “critical incidents” and their impact on the development process as defined in the effectuation process (Dew, Read, Sarasvathy, & Wiltbank, 2009; Kazanowski, 2020; Sarasvathy, 2001, 2016; Sarasvathy & Dew, 2001). The critical or surprise incident, known in effectuation as the lemonade principle (Speake, 2008), serves to review the product or process development steps for possible flaws that can keep bringing surprises instead of success (Kazanowski, 2020, p. 339). As demonstrated later in this study, critical incidents play a significant role in understanding the team members' behavior during and after the adjourning phase of Tuckman’s model of team development.

In another study, Kazanowski and Walton (2021) discussed the effects of collective team tenure on product development performance. The collective team tenure defines the amount of time a team has spent together (Gonzalez-Mulé, S. Cockburn, W. McCormick, & Zhao, 2019; Stahl, Maznevski, Voigt, & Jonsen, 2010). One of the findings by Kazanowski and Walton (2021) is that not all team characteristics are equally valid for determining the product development team performance and that future research should include the creation and validation of an appropriate instrument. This study answered the call for more research on the adjourning phase of team development and proposed a preliminary scale based on the mixed-method research results on the adjourning phase of Tuckman's team development model.

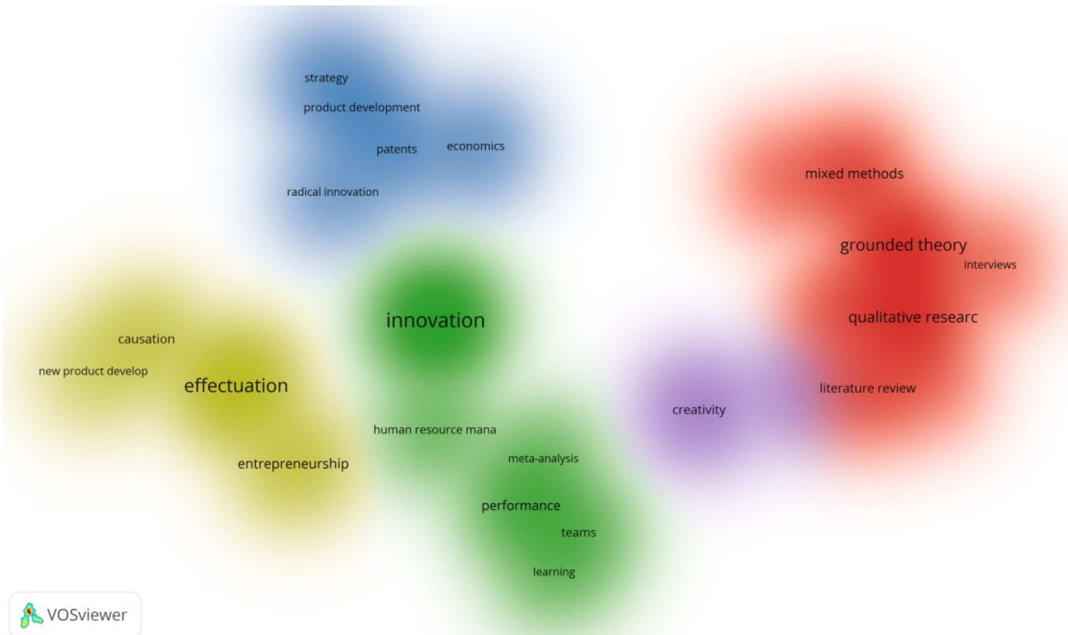

Figure 5 Disciplinary profile map by the research areas and themes

Over one thousand publications, including peer-reviewed journal articles, conference papers, dissertations, book chapters, and web-exclusively publications, were collected for this study between 2019 and 2021. A disciplinary profile map in Figure 5 illustrates the scientific literature breakdown in product development into smaller research areas using the references collected for this study between 2019 and 2021.

VOSviewer, a freely available computer program for the graphical representation of bibliometric maps (van Eck & Waltman, 2010, 2014b), created a disciplinary profile presented in Figure 5 using papers and publications indexed in Mendeley. The profile map shows that the references gathered for the adjourning phase of the team development study are rooted in several scientific fields that fall under innovation, strategy, entrepreneurship, teams, and creativity (Kazanowski & Walton, 2021). The additional field in Figure 5 indicates grounded theory, interviews, and mixed methods as the primary research instruments selected for this mixed-methods study.

Literature review in Grounded Theory

Using literature represents a contentious and divisive issue within grounded theory research (Dunne, 2011). Glaser and Strauss (1967) initially argued explicitly against using literature. Since the publication of *The Discovery of Grounded Theory* by Glaser and Strauss in 1967, the debate on the literature review position shifted from not doing it to when to complete it and how extensive it should be (Cutcliffe, 2000; McGhee, Marland, & Atkinson, 2007).

Glaser (1998) wanted the grounded theory researcher to be as open and unrestricted as possible while discovering emerging concepts. Glaser (1998) remained firm in his position on the place of the literature search while doing the grounded theory research:

> *Grounded theory's very strong dicta are a) do not do a literature review in the substantive area and related areas where the research is to be done, and b) when*

> *the grounded theory is nearly completed during the sorting and writing up, then the literature search in the substantive area can be accomplished and woven into the theory as more data for constant comparison. (p. 67)*

Strauss and Corbin (1998) viewed literature review as an instrument for sensitizing the researcher and a guide for directing theoretical sampling. Strauss and Corbin (1998) adopted a less firm position on the place of the literature search while doing the grounded theory research than Glaser (1998):

> *It is not unusual for students to become enamored with a previous study (or studies) either before or during their own investigations, so much so that they are nearly paralyzed in an analytical sense. It is not until they can let go and put trust in their abilities to generate knowledge that they finally can make discoveries of their own. (p. 49)*

In summary, the literature review is a part of conducting the grounded theory research; however, the researcher may not know the most relevant literature while beginning the study. On the other hand, a researcher should begin the grounded theory with an open mind rather than an empty head not adequately steeped in a discipline's research traditions (Giles, King, & De Lacey, 2013).

Organization of the Remainder of this Chapter

This researcher followed a Straussian approach to the grounded theory research (Corbin & Strauss, 2015; Walker & Myrick, 2006) and completed the initial round of the literature review.

The chapter's first section reiterates the research questions guiding this study. The second section reviews the evolution of the research field related to product development and the product development team's position within this field. The third section of this chapter includes a review of the literature on team development. This section gives an overview of various stage-based team development models and includes a detailed discussion of Tuckman's model, including the genesis of adjourning phase and a discussion of the limitations and theoretical applicability. The focus of the final section is on the team performance and team development measures.

Questions that Guide the Research

The following research questions guided this study:

1. What team member behavioral characteristics, derived from the interviews with product development professionals representing the light metal forming industry, change during Tuckman's adjourning phase?
2. If the derived characteristic behavior's change is present, how to determine the level of change?

Product development and product development teams

During the past 40 years, the pace of research on the product development team performance significantly increased. The field of innovation and knowledge management in the 1980s focused on individual creativity and innovation. Barron and Harrington (1981) listed several varieties of individual creativity. The authors discussed work on connecting personality, process, and product using the examples potentially explaining how an architect's personality and the style of his work or the writers' temperament impact their work characteristics (Barron & Harrington, 1981). Mumford and Gustafson (1988) extended the traditional interpretation of innovation and underlined individual differences in creativity. The authors indicated that the effective translation of ideas into actions would depend on various situational attributes (Mumford & Gustafson, 1988). Several studies published by Amabile in the late 1980s culminated with a model integrating individual creativity into a preliminary model of organizational behavior combining expertise, creative thinking skills, and motivation (Amabile, 1988). Amabile concluded that individual creativity is crucial in organizational innovation and that organizational factors influence individual creativity.

In the 1990s, the research focus on innovation and knowledge management turned to organizational innovation. Damanpour (1991) completed a meta-analysis of the relationship between organizational innovation and over ten potential determinants. The results indicated that it is possible to build and rigorously test the theories in organizational innovation (Damanpour, 1991), like the integrative model of factors affecting product development by Brown and Eisenhardt (1995). The idea behind this model encompasses

Amabile’s conclusion that multiple players are influencing product development performance. The authors also recognized the central role of the project development team (Brown & Eisenhardt, 1995).

In the early years of the twentieth century, the product development best practices received some attention, including the best practices framework for product development (Kahn, Barczak, & Moss, 2006). Another aspect highlighted in the product development best practices framework is its applicability to radical innovation by various teams (Kleinschmidt, 2006). Radical innovation may require more than a single framework can offer. It could be a less formal and multilevel approach, with each level providing enough constructs for the ongoing product development process (Bhuiyan, 2011). Recently, the entire organization's innovative contributions, including Human Resources Management (HRM), are gaining recognition (Shipton, Sparrow, Budhwar, & Brown, 2017). The main challenge for any HRM team is to leverage individual and group creativity. The prevailing view is that enhanced management practices, including HRM practices, have a crucial function in managing the innovation processes (McKeown, 2019; Jiménez-Jiménez & Sanz-Valle, 2008).

In summary, team development research evolved from studies of individual creativity studies (the 80’s) to organizational innovation studies (the 90’s). Research on product development best practices and co-creation dominated the early day of the 21st century. Recent years have witnessed a gradual increase in the research topics discussing the management practices and their leverage on the product development team performance.

The global market's rapid growth drives organizations' investments in product development (R. Cooper, 2017, 2019; R. Cooper & Kleinschmidt, 2007; Wong & Tong, 2012). Cooper (2019) summarized the drivers of success in new-product development and stated that *“product innovation is very much a team effort”* (p. 42). According to Cooper (2019), an effective cross-functional product development team following the innovation strategy and voice-of-customer is essential to launching new products.

COVID-19 pandemic impacted many aspects of modern business, including product development activities. One of the COVID-19 pandemic results is an accelerated rise of distributed teams and related technologies (Balzerkiewitz & Stechert, 2020). The distributed teams are scattered in time and space and have become common among new product development teams (Péréa & von Zedtwitz, 2018). The globally distributed firms are trying to establish a sequence of product development steps that is easy to follow and deploy in various regions (Harvey & Griffith, 2007). The distributed teams are less coherent, and the research reported in the literature focuses on distributed team management and task coordination (Felekoglu, Maier, & Moultrie, 2013). This study does not cover the distributed teams.

Team Development

The temporal unfolding during a team's evolution is a central feature of developmental models (Kozlowski et al., 1999). Product development teams, like other teams, require time to mature. They form, establish regulatory mechanisms, and evolve through a series of recognizable changes (Kozlowski et al., 1999).

In 2001, Offermann and Spiros examined the link between science and team development practice. The authors surveyed 442 members of the Academy of Management's Organizational Development and Change Division. One of the research questions was about the respondents' preferred theories and models helpful for their studies of groups and teams. The 150 out of 442 respondents to this question reported 250 different models or theories (Offermann & Spiros, 2001, p.384). The most frequently mentioned was Tuckman's model (Tuckman, 1965). Table 1 lists some of the groups and team development models found in the literature, and the following section summarizes some of these team development models. The team development stages (1) early development, (2) development, and (3) disbandment used in Table 1 are subjective and included for the reader's comfort of visualization only.

Bach (1954) established a three-phase model of group development, including initial situation testing, leader dependence, and the workgroup. Bach (1954) used his long-term group therapy experience and cautioned that proposed phases are probably characteristic of a long-term dynamic process. Moreover, the phases do not have to follow an orderly succession and vary depending on circumstances (G. R. Bach, 1954).

Table 1 Groups and team development models present in the literature[1]

Source	***Developmental Stage***				
	Early Formation		***Development***		***Disbandment***
Bach (1954)	Situation testing	Leader dependence		The workgroup	-
Bion (1961)	Dependence	Pairing	Fight-flight	The work phase	-
Tuckman (1965)	Forming	Storming	Norming	Performing	-
Whittaker (1970)	Pre-affiliation	Power & control	Intimacy	Differentiation	Separation
Yalom (1970)	Orientation	Conflict	Intimacy		Termination
Braaten (1974)	Initial phase	Early phase	Mature work phase		Termination
Tuckman & Jensen (1977)	Forming	Storming	Norming	Performing	Adjourning
Caple (1978)	Orientation	Conflict	Integration	Achievement	Order
Garland, Jones, & Kolodny (1978)	Pre-affiliation	Power & control	Intimacy	Differentiation	Separation
Wheelan & Hochberger (1996)	Dependency & inclusion	Counter - dependency & fight	Trust & Structure	Work	Termination
Rickards & Moger (2000)	Forming & Storming		Norming & Performing		Outperforming

[1] The lines separating team development models in individual models are arbitrary and used for ease of comparison exclusively.

Bion’s model of group development (1961), outlined in a series of papers published between 1948 and 1959, combines a phase model with a cyclical model. Bion’s model of group development assumes that at any time, the group culture exhibits a certain equilibrium between dependency, pairing, and fight-flight. Bion (1961) shared his perception of the group dynamics, stating that his initial observations of group interactions seemed incoherent, bizarre, and incomprehensible; however, after some time, they began to point out patterns. Although Bion does not use the term “grounded theory,” his description of the research method is reminiscent of the processes described in *The Discovery of Grounded Theory* (Glaser & Strauss, 1967). Bion's work stimulated a varied range of group workers resulting in work fundamental to human associations as diverse as therapy groups and business offices (Braaten, 1974).

Whittaker (1970) integrated the existing formulation of group development into a five-stage model of group development, including the separation stage. Whittaker’s model combines a phase model and a model postulating cyclical concerns with a unique contribution to the possible description of team members' behavior within the established team. Whittaker (1970) postulated that *disturbing* motives presumably trigger so-called *reactive* motives. For example, during group termination (*disturbing* motive), the group members could exhibit denial, separation anxiety, repression, and anger (*reactive* motives).

In 1970, Yalom published a revised edition of *Theory and Practice of Group Psychotherapy*. Similar to the statements by Whittaker (1970), Yalom claimed that adequate group performance could depend on selecting participants, the group's composition, and creating a productive physical setting. One of the most striking statements by Yalom (1970) comes from his discussion of terminations of the advanced group. Yalom stated that *"Termination is more than the end of therapy; it is an integral part of the process and, if properly understood and managed, an important force in the process of change"* (Yalom, 1995, p. 361). The work published by Yalom (1970) inspired this researcher to focus on the teams facing termination-like situations and explore how the team members react to the termination-like situations possibly experienced by the product development team members during and just after the joint ventures, mergers, acquisitions, or significant technological changes.

Braaten's Composite Model of group development (1974) assumed that there are enough similarities among different types of dynamic groups to justify an attempt at constructing a composite model of group development. The unique phase of Braaten's model is the pre-group phase (Braaten, 1974). Braaten's pre-group phase builds on Yalom's advice about participants' selection, group composition, and a physical setting (Yalom, 1995). Braaten (1974) stated that completing the pre-group phase successfully will positively impact the group process.

Caple (1978) proposed a model of group development containing five stages of development, each with a central issue. The final stage of Caple's model is the order stage, where the group members grow more established and resist reassessing norms (Caple, 1978). Furthermore, group members with no specified time limit would defend the group's way of doing things because of past success (Caple, 1978, p. 474). Caple's (1978) observations are one of the initial results reported in the literature about the teams with no specific time limit that still develops one stage at a time.

In 1978, Garland et al. proposed five stages model of group development as a tool for managing and programming social workgroups. The stages of group development included in the model are pre-affiliation, power and control, intimacy, differentiation, and separation (Garland, Jones, & Kolodny, 1978). Garland et al. (1978) indicated that different groups progress through developmental stages at a different speed and that conflicts could be triggered while approaching the phase change. Garland et al.'s (1978) model also suggested that the group members may begin to move apart during the separation phase and find new resources for meeting social, recreational, and vocational needs (Garland et al., 1978, p. 57).

Tuckman's 1965 model

As indicated in the study by Offermann and Spiros (2001), Tuckman's model is the most highly accepted model of the dynamic process by which teams are formed and become functional. The model has been part of the curriculum in practitioner seminars and university classrooms for more than five decades (Betts & Healy, 2015).

In 1965, Tuckman published a meta-analysis of 50 papers, including psychoanalytic studies of therapy groups. Tuckman (1965) focused on interpersonal relationships and task activity deducted from the published reports and papers and hypothesized a four-stage model and coined the following names for each stage (1) *forming*, (2) *storming*, (3) *norming*, and (4) *performing*. Tuckman described the process as follows:

> *"My first professional job was as part of a small group of social psychologists in a think tank setting studying small group behavior as the US Navy prepared for a future of small crew vessels and stations. Nine of us at the Naval Medical Research Institute were busy studying small groups from all perspectives and under all conditions. I was for-tunate to have an experienced and talented boss by the name of Irwin Altman, who had been collecting every article he could find on group development. He turned his collection over to me and suggested that I look it over and see if I could make anything out of it.*
>
> *The collection contained 50 articles, many of which were psychoanalytic studies of therapy or T-groups. The task of organizing and integrating them was challenging. After separating out two realms of group functioning, namely, the interpersonal or group structure realm and the task activity realm, I began to look for a developmental sequence that would fit the findings of a majority of the studies. I hit on four stages going from (1) orientation/testing/dependence, to (2) conflict, to (3) group cohesion, to (4) functional role-relatedness. For these, I coined the terms: 'forming,' 'storming,' 'norming,' and 'performing'"* (Tuckman, 1984)

During the first stage of team development, called *forming*, the group becomes oriented to the task and could create ground rules and establish relationships within the team and the organization. The second stage, *storming*, represents a time of intergroup conflict characterized by a lack of unity and polarization around interpersonal issues. Tuckman (1965, p. 386) stated that *"group members become hostile toward one another and a* *therapist or trainer, as a means of expressing their individuality and resisting the formation of group structure."* Throughout the third stage, *norming*, the group develops cohesion by accepting each other idiosyncrasies and developing the most effective ways to work with each other. The final stage of the original model, *performing*, begins when the group members start to channel their energy into the task. The roles within a group are clear and accepted by the group members.

Interestingly, the only test of Tuckman's four-stage model, published by Runkel et al. (1971), used results gathered by students tasked with observing the workgroups (Bonebright, 2010; Ravi & Sumathi, 2016; Sekaran, 2003; Tuckman, 2001; Tuckman & Jensen, 1977). These students learned about Tuckman's model just a year before yet still could identify all four development phases (Runkel, Lawrence, Oldfield, Rider, & Clark, 1971). Runkel et al. (1971) concluded that *"the stages seem rather easily visible to briefly trained observers."* Almost 60 years later, Tuckman's model provides a similar and accessible starting point for a conversation about crucial issues surrounding the team development process in a sample of product development teams found in the light metal forming industry.

The genesis of adjourning phase

In 1977 Tuckman and Jensen were invited by *Group Organizational Studies* to publish an update to the model (Bonebright, 2010). Tuckman and Jensen (1977) acknowledged that the model of team development proposed by Tuckman (1965) was a conceptual statement and subject to further tests (p. 5). Tuckman and Jensen (1977) collected fifty-seven articles published between 1965 and 1976 and referenced the original paper by Tuckman published in 1965. As explained earlier in this chapter, only one study among fifty-seven articles tested Tuckman's hypothesis (Runkel et al., 1971). Runkel et al. (1971) showed a good fit with Tuckman's hypothesis and did not indicate a lack of any phases in the model.

A significant outcome of the literature review by Tuckman and Jensen (1977) was a discovery of the final discernible and significant stage of group development – termination. Tuckman and Jensen (1977) leaned heavily on the study by Braaten (1974) that compiled most of the existing models of team development and demonstrated the termination phase's existence. Inclusion of the separation phase in the phase-based model of team development by Whittaker (1970) and the inclusion of termination as an integral part of the team development cycle by Yalom (1970) strengthened Tuckman and Jensen's conviction about a need to expand the original model (Tuckman & Jensen, 1977, p. 427).

In summary, Tuckman and Jensen (1977) included the fifth stage in the original model by Tuckman (1967) and called it *adjourning*. Interestingly enough, Tuckman and Jensen did not summarize expected team behavior characteristics during the adjourning phase of the team development neither in their publication on the amended model (Tuckman & Jensen, 1977, p. 427) nor in the subsequent publications on sequential group development (Tuckman, 2001; Tuckman & Jensen, 2011).

Tuckman's model in research

After importing publications indexed for this research by the Mendeley Desktop application, the CitNetExplorer software created the summary of the citations of Tuckman's stages of group development between 1965 and 2020, presented in Figure 6. CitNetExplorer visualizes the most important publications in a user-specified field and shows the citation relations between user-gathered publications to indicate how publications build on each other (van Eck & Waltman, 2014a, 2017).

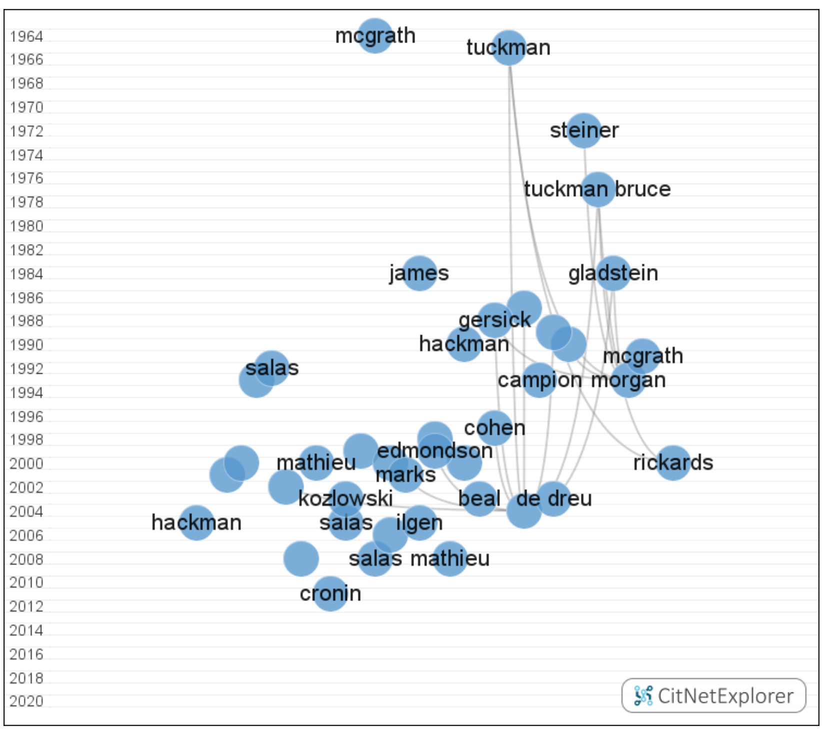

Figure 6 The publication oeuvre of Tuckman on the stages of group development

Figure 6 shows two groups of citations related to the team development detected among over one thousand publications, including peer-reviewed journal articles, conference papers, dissertations, book chapters, and web-exclusively publications, collected by the author of this study between 2019 and 2021. Each node in Figure 6 represents an individual citation and uses the publications author's last name as the node's ID. The lines between nodes indicate the direct citation – for example, Gersick (1989) cited the original paper by Tuckman (1964) in her work on the punctuated equilibrium (Gersick, 1989).

The two groups of citations presented in Figure 6 indicate research on stage-based team development (McGrath, Arrow, & Berdahl, 2000; Rickards & Moger, 2000; Tuckman, 1965; Tuckman & Jensen, 1977; Van Knippenberg, De Dreu, & Homan, 2004; Wheelan & Hochberger, 1996) springing from the original work of Tuckman (1964) and the other models of the team development like the punctuated equilibrium (Gersick, 1989), a process in the context of a multiphase episodic framework related to goal accomplishment (M. A. Marks, Mathieu, & Zaccaro, 2001), team developmental continuum and transition points (Kozlowski et al., 1999), integrated model of team performance and training (Swezy & Salas, 1992), teams embedded in organizations (Ilgen, 1999; Ilgen & Pulakos, 1999; Kozlowski et al., 1999), or high performing teams (Hackman, 2002). This researcher used the amended Tuckman's team development model (Tuckman & Jensen, 1977) while accepting the model's limitations discussed in the following section.

Limitations of Tuckman’s model

Tuckman (1965) identified several limitations of the four-stage model. Tuckman’s primary model limitation is that the literature review is not a representative sample of the settings for the small group development processes. The other limitations include a lack of quantitative research rigor and controlling independent variables (Tuckman, 1965). Further analysis of the model yielded additional limitations. Several authors pointed out that the model lacks a complete explanation of how groups change over time (Rickards & Moger, 2000), how the group’s activities change over a group's life (Miller, 2003), how robust are the five stages definitions (Forsyth, 2010, p. 134; Katzenbach & Smith, 1993), or if the stages of the team development overlap (Gonzalez-Mulé et al., 2019).

One of the most significant limitations of examined stage-based team development models, including the five-stage development model by Tuckman and Jensen (1977), is minimal attention to the final stage of the team development process. As presented in Table 1, several models do not include any definition of this phase (G. R. Bach, 1954; Bion, 1951; Tuckman, 1965). Other models mention adjourning (or a similar phrase) without providing enough substance to understand the details of the team development process during the post-peak performance stage (Braaten, 1974; Caple, 1978; Garland et al., 1978; Rickards & Moger, 2000; Tuckman & Jensen, 1977; Wheelan & Hochberger, 1996; Whittaker, 1970; Yalom, 1995). None of these studies, including Tuckman’s, indicate the team members' characteristics likely to change or develop during the team adjourning stage, giving this researcher an additional motivation to address the gap observed in the literature about the final stage of team development.

Researchers, engineers, designers, and programmers often collaborate on assigned or original projects. Their cycles of work may be longer than in production and service. They may have a mandate of innovation more than implementation, broad autonomy, and extended team tenure (Sundstrom, De Meuse, & Futrell, 1990). This mandate makes the product development team feasible to study team development phenomena during company ownership change (Sigman, 1991) or times of significant and rapid technological change (Romanelli & Tushman, 1994; Schaffer, 2000).

Tuckman's model in practice

Tuckman's model offers a simple means of discussing and exploring team dynamics (Miller, 2003, p. 122) and has not diminished since the amended model's publication in 1977 (Bonebright, 2010, p. 119). At the beginning of the 21st century, the model kept appearing in studies of a wide variety of work settings, from project teams (Dyer & Ericksen, 2004; Rickards & Moger, 2000) to leadership (Wheelan & Hochberger, 1996), public health partnerships (McMorris et al., 2005) and study of routinization among nurses (Garfield & Dennis, 2012).

The popularity of the Tuckman and Jensen model could also be related to the attractiveness of the labeling. The phrase *"forming-storming-norming-performing"* carries much intuitive meaning for practitioners, trainers, and students. The intuitiveness, or quotability (Tuckman, 1984), of this phrase, could lead to the situation in which the categories like *"forming-storming-norming-performing"* are used but not themselves examined as ways of thinking (Parlett, 1991). They serve as a malleable metaphor (Schon, 1963) to make sense of the phenomenon before us while possibly obscuring the true meaning of the initial four-stage model by Tuckman.

Several researchers attempted to extend Tuckman's theory (Maples, 1988) or explore the complexity of the group development model through Tuckman's model lens (Jack & Brotheridge, 2008; Ravi & Sumathi, 2016). One researcher even tried to combine Tuckman's model of group development (1977) and Gersick's punctuated equilibrium model (1992) into *The Punctuated-Tuckman* group development model and contrasted it with his group development model originating from a systems perspective (Hurt & Trombley, 2007).

The original Tuckman's model proved to be a one-of-a-kind model with a lasting impact on generations of researchers studying team development (Bonebright, 2010). Tuckman (1965) offers the following suggestion to the scholars and researchers planning to use the model:

> *"The major task of systematically studying the effects of various appropriate independent variables on development still remains. The value of the proposed model is that it represents a framework of generic temporal change within which the above explorations can be nested and which should lead to the derivation of many specific hypotheses relating independent variables to the sequence of temporal change. Such quantitative explorations will undoubtedly lead to refinements and perhaps major modifications of such a model.*

Team performance measures

There are many definitions and measurements of team performance; however, a consistent definition for group performance is still missing. Operalization of team performance is generalized as task effectiveness or team productivity (Gruman & Saks, 2011). Examples of measures of team productivity include financial performance (Return on Investment, margins, time to break even), product-level performance (product cost, time to launch, quality guidelines), and customer acceptance measures (customer satisfaction, revenue, market share) (Crawford & Di Benedetti, 2008). However, researchers interested in predicting product development team performance should consider interpersonal processes (M. A. Marks et al., 2001). Interpersonal processes are more likely to influence team cohesion over time, making it an antecedent of team tenure and satisfaction (Huckman, Staats, & Upton, 2012).

There are numerous models of team performance (Gersick, 1989; Kozlowski et al., 1999; M. A. Marks et al., 2001; Swezy & Salas, 1992; Tuckman, 1965). Each of these models proposes several variables that, according to the authors, influence the effectiveness of teams. Some models highlight teamwork training (McEwan, Ruissen, Eys, Zumbo, & Beauchamp, 2017) and other group efficacy (Gibson, 2016). Still, others emphasize external factors like the company's culture (Felipe, Roldán, & Leal-Rodríguez, 2017). One of the most unusual team effectiveness models assumes that all teams can be dysfunctional (Lencioni, 2012). According to Lencioni, it is critical to understand the type and level of dysfunction before improving a team's functioning. Lencioni (2012) used a pyramid to visualize the hierarchical progression of team development. The five levels are similar to

Maslow’s Hierarchy of Needs Theory (Maslow, 1943). There are five potential dysfunctions of a team in Lencioni’s model: (1) absence of trust, (2) fear of conflict, (3) lack of commitment, (4) avoidance of accountability, and (5) inattention to results. The Lencioni Team Assessment tool provides a sense of a team’s unique strengths and areas for improvement against the Lencioni model of five dysfunctions of a team. Lencioni (2012) suggested that the whole team complete the assessment for a more accurate analysis.

Table 2 Examples of team performance assessment tools found in the literature

Source	*Assessment*	*Scope of assessment*	*Team dimensions assessed*
Hallam & Campbell (1997)	Campbell-Hallman Team Development Survey	Team performance and development with a focus on strengths and weaknesses	Resources, Efficiency, Improvement, Success
Hackman (2002)	Team Diagnostic Survey	Team structure, support, leadership	Level of effort, Appropriateness of the performance strategies, Member’s knowledge & skill
Lencioni (2012)	Five Dysfunctions of a Team	Five dysfunctions of a team	Absence of trust, Fear of Conflict, Lack of Commitment, Avoidance of accountability, Inattention to results

Table 2 lists the tools and the scope of assessment and evaluated team dimensions. The team assessment tools listed in Table 2 have several common characteristics; (1) measure the perception of team members, (2) return this information to the team so the team can use it to improve performance, (3) help team leaders identify critical conditions that they can put in place to increase the likelihood of team success. Tools listed in Table 2 could help assess team performance at a given time (Hallam & Campbell, 1997); however, they were not designed to detect the team development stage.

Most temporary groups have an ending point or the final stage called adjourning (Tuckman & Jensen, 1977), separation (Whittaker, 1970), order (Caple, 1978), or termination (Lacoursiere, 1974). Most authors agree that the end of the project or group work alters the group's structure, and regression to earlier stages is likely (Garland et al., 1978). As a result, termination points can cause a reoccurrence of conflict and negativity (Wheelan & Hochberger, 1996). In some cases, the members in groups with no specified time limit will defend the group’s way of doing things, and the group’s way of doing things gradually becomes more important than the goals or the task (Caple, 1978). These characteristics of the team and team members' performance are congruent with the team performance characteristics typical to the adjourning phase of Tuckman’s model (Hollenbeck, Beersma, & Schouten, 2012; Maples, 1988; Offermann & Spiros, 2001; Rickards & Moger, 2000; Tuckman, 1965; Tuckman & Jensen, 1977; Wanous, Reichers, & Malik, 1984). The most prominent observation made during the systematic literature review for this project is the absence of instruments capable of assessing team performance during the adjourning phase of team development.

In their study of group development, Wheelan and Hochberger (1996) described an instrument's theoretical underpinning, construction, and validation process designed to measure development processes in groups. The stages of the Wheelan-Hochberger model are (1) dependency and inclusion, (2) counter dependency and fight, (3) trust and structure,

(4) work, and (5) termination. Wheelan and Hochberger (1996) note that even continuous institutional groups like product development teams experience various endings like task completion, team members' retirement, company mergers, or firm closing. Impending termination alters a group's structure, and regression to earlier stages is possible (Bion, 1951; Garland et al., 1978; Yalom, 1995). Despite including the termination phase in their model, Wheelan & Hochberger (1996) did not include it in the *Group Development Questionnaire*. Two reasons cited by Wheelan and Hochberger (1996) for not including the fifth scale to measure the termination phase of group development are (1) no instrument designed for use with continuing groups, and (2) the termination phase of group development has insufficient empirical validation to be included in an instrument at the time of publication.

Summary

This researcher followed the Straussian approach to grounded theory research, including completing a systematic literature review (Corbin & Strauss, 2015; Glaser & Strauss, 1967). On the other hand, this researcher also followed Howard Becker's advice on searching the literature: "*use the literature; don't let it use you*" (Becker, 2007, pp. 135–149).

The team development research evolved from individual creativity studies (the 80's) to organizational innovation studies (the 90's). Research on product development best practices and co-creation dominated the early day of the 21st century. Recent years have witnessed a gradual move of the research topics to a discussion of the management practices and their leverage on the product development team performance.

Bach (1954) proposed one of the initial stage-based team development models. Bion (1961) introduced a group equilibrium idea through a grounded theory-like study of psychotherapy groups. Whittaker (1970) included the separation phase into the phase-based model, and Yalom (1970) concluded that the termination phase is an integral part of the team development process. Braaten (1974) proposed a pre-group phase that sets the stage for a better group performance, while Caple (1978) extended the order stage into groups with no specified time limits.

In 1965, Tuckman proposed a four-stage team development model, including forming, storming, norming, and performing. In 1977, Tuckman and Jensen amended the model and included the fifth stage – adjourning. Tuckman and Jensen (1977) did not offer any team characteristics unique to the adjourning stage of the team development process. Several researchers tried to fill this gap (Betts & Healy, 2015; Caple, 1978; Dierdorff, Bell, & Belohlav, 2011; Hallam & Campbell, 1997; Hollenbeck et al., 2012; Hurt & Trombley, 2007; Jack & Brotheridge, 2008; Kozlowski et al., 1999; Lacoursiere, 1974; Maples, 1988; Rickards & Moger, 2000; Wanous et al., 1984).

While the literature gap on adjourning remains open (Wheelan & Hochberger, 1996), Tuckman's model still serves as a platform for research on team development in various environments (Bonebright, 2010). This study investigated adjourning phase behavior in a sample of product development teams and proposed a scale that the practicing managers could use to gauge their teams' performance. This researcher believes that this study's results answered the call for additional empirical validation of the adjourning phase.

Chapter 3
Methodology

Overview

The mixed-methods sequential exploratory design to investigate the adjourning phase behavior in a sample of the product development teams in the light metal forming industry used in this study consists of three distinct phases: the qualitative phase followed by two quantitative phases (Creswell & Plano Clark, 2018). Figure 7 shows the mixed-methods exploratory sequential procedures with instrument development designed for this study.

Organization of the Remainder of this Chapter

This chapter begins with an overview of the mixed methods approach and details of the mixed-methods exploratory sequential design. The following section describes the grounded theory's essential elements used for data collection during the qualitative phase. Discussion on data collection presents items related to the semi-structured interview as the main data source. Checklists for methodological consistency and applicability of a grounded theory (theoretical sampling, methodological journal, preparing data for coding, bracketing, memoing, integration in memos, and diagraming) used in this study are provided in Appendix E and Appendix F.

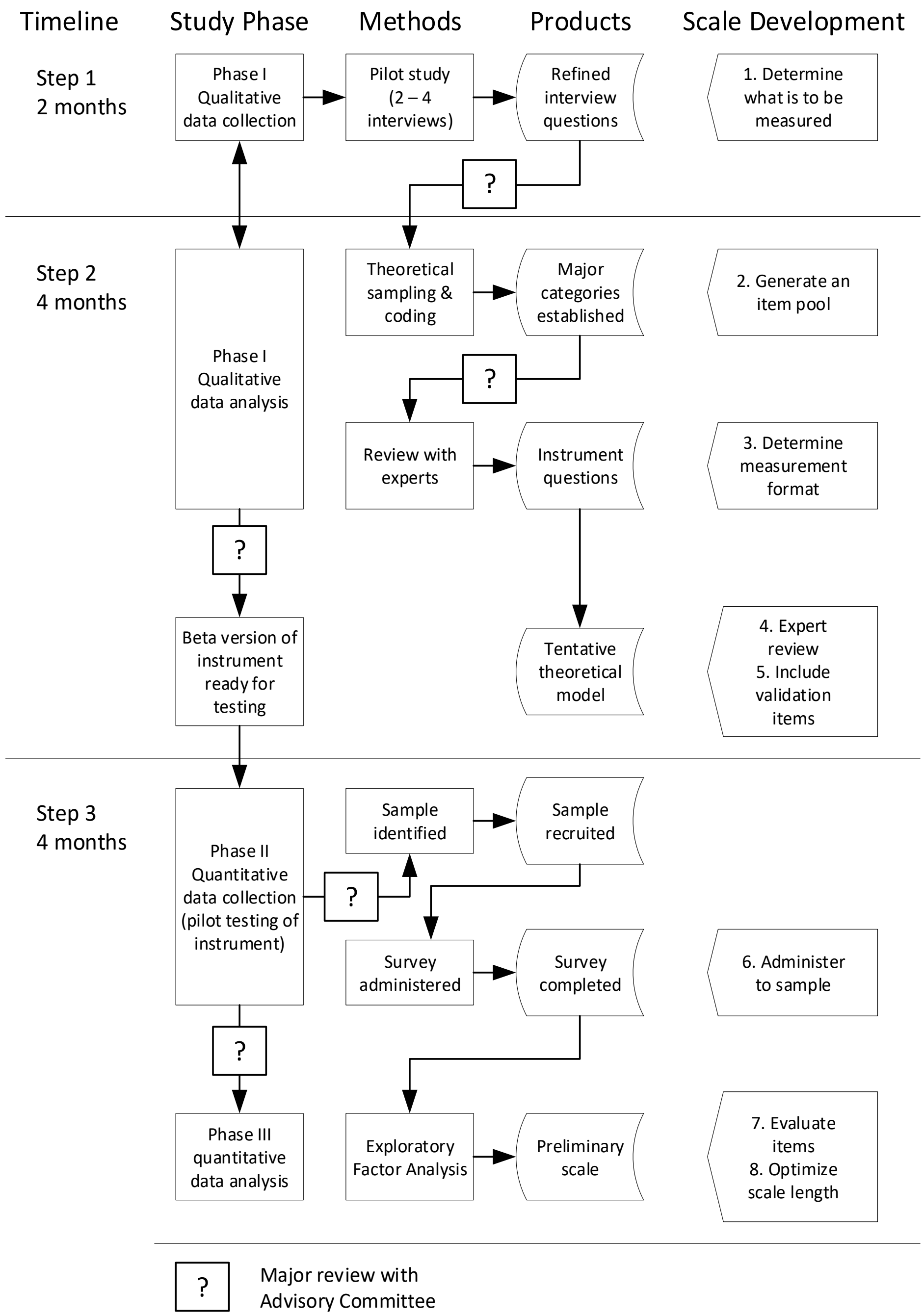

Figure 7 Procedures for an exploratory sequential study with instrument development

Worldview

Business research is a systematic process of finding solutions to a specific problem encountered in work settings (Saunders, Lewis, & Thornhill, 2019). The process is a data-based objective scientific inquiry into a specific problem (Sekaran, 2003). Following a scientific approach should help the researcher get to the truth about the research subject (Gray, 2004).

Creswell and Poth (2018) recommend identifying the philosophical views or worldviews to guide the research. This researcher was not committed to any one system of philosophy and reality, values freedom of choice, and was interested in applying the research results. According to Cherryholmes (1992) and Mitchell (2018), no commitment to one system of philosophy, freedom of choice, and looking to the "what" and "how" are characteristics of pragmatism. For this study, this researcher adopted some of the elements of the pragmatism philosophy mentioned above.

Research Questions

The following research questions guided this study:

1. What team member behavioral characteristics, derived from the interviews with product development professionals representing the light metal forming industry, change during Tuckman's adjourning phase?
2. If the derived characteristic behavior's change is present, how to determine the level of change?

Research Design

Creswell and Poth (2018) argue a correlation between appropriate research methodology, research questions, and the study goals. Given (2008) states that through qualitative research, the researcher can explore human elements of a given topic by using specific methods to examine how individuals see and experience the world.

Methodological issues receive increasing attention in the field of team research. Examination of teams in their natural context at multiple points in time (Sundstrom et al., 1990), the sensitivity of small team research to time (Ilgen, 1999), diagnosis of teams as organizational units (I. C. Kerssens-van Drongelen & Cook, 1997), tracking performance changes and differences (A. W. Pearson et al., 2000) require a multi-method approach including but limited to, multilevel analysis and survey-based research (Hallam & Campbell, 1997; Kozlowski et al., 1999; Swezy & Salas, 1992).

The investigators do not always know what questions to ask, variables to measure, or theories to guide the study (Saunders et al., 2019). Creswell and Plano Clark, 2018, p. 9) advise that in these situations, *"it is best first to explore qualitatively to learn with questions, variables, theories, and … follow up with a quantitative study to generalize and test what was learned from the exploration."* As a branch of multiple methods that integrate quantitative and qualitative data collection and analytical procedures in the same project, a mixed-method project is ideal in these situations (Creswell & Plano Clark, 2018).

Mixed methods research offers several advantages: (1) harness the strength of qualitative and quantitative methods while offsetting the weaknesses of both methods (Jick, 1979); (2)

provides more evidence for studying a research problem than either qualitative or quantitative research alone and helps answer questions that cannot be answered by either method alone (Creswell & Plano Clark, 2018); (3) offers new insights and opportunity for integration of the results that go beyond individual quantitative and qualitative results (Fetters, Curry, & Creswell, 2013); and (4) encourages the use of multiple views, including paradigms, associated with quantitative and qualitative research (Tashakkori & Teddlie, 2015).

In summary, mixed methods exploratory sequential design served as a way to collect and analyze the data provided by the product development team members, connect the qualitative data results with the quantitative inquiry, and support the instrument design (see Figure 9 for more information). The following section provides more information on the sequential design, including a detailed description of tasks completed at each step.

Mixed Methods Exploratory Sequential Design

Numerous classifications are available for the mixed methods (Creswell, 2015; Creswell & Plano Clark, 2018; R. B. Johnson, Onwuegbuzie, & Turner, 2007). Creswell and Plano Clark (2018) recommend three core mixed methods designs providing a framework for researchers planning their studies. The three core designs underlying all mixed methods studies are a convergent design, an explanatory design, and an exploratory sequential design (Creswell, 2015).

As depicted in Figure 8, the mixed-methods exploratory sequential design is a three-phase design. The project begins with collecting and analyzing qualitative data, followed by the development phase focused on translating the qualitative findings into a tool appropriate for quantitative testing. Creswell and Plano Clark (2018, p.84) clearly stated that by following the exploratory sequential design, *"the tool will be grounded in the views of participants"* and *"the quantitative feature is based on the culture or setting of participants rather than pulled "off the shelf" for use."* When used to develop an instrument, this design is referred to as the instrument development design (Creswell et al., 2004; Enosh et al., 2015).

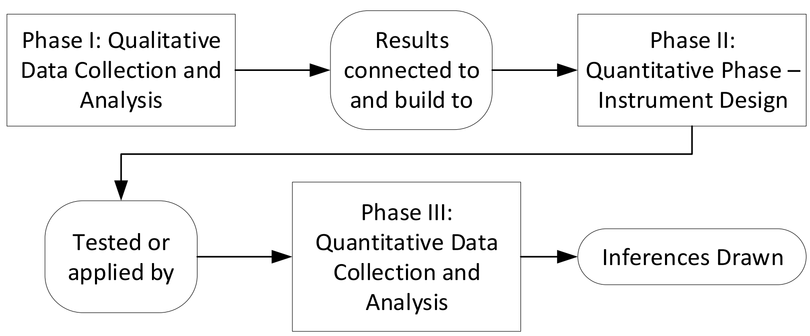

Figure 8 General diagram for Exploratory Sequential Design

(Creswell & Plano Clark, 2018)

Step 1

Design and Implement the Qualitative Strand:

- State qualitatively research questions and determine the qualitative approach
- Obtain permissions
- Identify the qualitative sample
- Collect open-ended data with protocols
- Analyze the qualitative data using procedures of theme development and those specific to the qualitative approach to answer the qualitative research questions and identify the information needed to inform the second phase: (a) research questions and (b) development of a new qualitative feature

Step 2

Use Strategies to Build on the Qualitative Results:

- Design and pilot test a quantitative data collection instrument based on the qualitative results
- Refine quantitative research questions or hypothesis and the mixed methods question
- Determine how participants will be selected for the quantitative sample

Step 3

Design and Implement the Quantitative Strand:

- State quantitative research questions or hypothesis that build on the qualitative results and determine the quantitative approach
- Obtain permissions
- Select a quantitative sample that will generalize or test the qualitative results and newly developed quantitative feature
- Collect close-ended data with the instrument designed from qualitative results
- Analyze the quantitative data using descriptive statistics, inferential statistics, and effect sizes to answer the quantitative and mixed methods research questions

Step 4

Interpret the Connected Results:

- Summarize and interpret the qualitative results
- Summarize and interpret the quantitative results
- Discuss to what extent and in what ways the quantitative results generalize of test the qualitative results

Figure 9 Flowchart of the procedure in implementing an exploratory sequential mixed methods design (Creswell & Plano Clark, 2018)

The exploratory sequential mixed methods consist of four steps (Creswell & Plano Clark, 2018) presented in Figure 9. The design begins with collecting and analyzing qualitative data to explore a phenomenon, then identifies results on which the quantitative future will rest. Strategies used to build on the qualitative results could include developing an instrument, identifying variables, or designing an experimental intervention (Creswell & Plano Clark, 2018). This exploratory study proposed two research questions regarding the team characteristics change during Tuckman's adjourning phase of the team development. After securing the Institutional Review Board (IRB) permission and identifying the initial samples of participants, the product development professionals within the light metal forming industry received the Informed Consent forms for review and signing (see Appendix A for details). Due to COVID-19 induced travel and meeting restrictions, an MS Teams application replaced the face-to-face interviews. The open-ended interviews served as a foundation for the qualitative data analysis using procedures of theme development and those specific to the qualitative approach to answer the qualitative research questions and identify the information needed to inform the second phase.

These developments were a bridge between the initial qualitative phase and the subsequent quantitative strand of the study. Examination of the salient variables using the developed instrument is an example of activities characteristic of this phase. During the final stage of the explanatory sequential mixed-methods study, the researcher interpreted how the quantitative results generalize or extend the initial qualitative findings (Creswell, 2015). This exploratory study used the Straussian approach to grounded theory and focused on potential team behavior changes induced by extrinsic conditions like mergers or joint ventures observed in the light metal forming industry. This phase of the mixed-methods approach produced a model summarizing the qualitative strand of the research. The proposed model enabled the quantitative strand of the study, including a preliminary test of the proposed instrument. The methodological details of each mentioned above research strand, including the detailed discussion of the grounded theory, are provided in the following sections.

Grounded Theory

The history and development of grounded theory intertwine with larger currents in social scientific inquiry, particularly with tensions between qualitative and quantitative research in sociology in the United States in the early 1960s (Bryant & Charmaz, 2007; Charmaz, 2014). Anselm Strauss studied at the Chicago University (1949-1945), where he most likely was exposed to John Dewey's pragmatism or "cultural naturalism" (Dewey, 1919, 1925) and the works of another pragmatist, George Herbert Mead (Birks, Hoare, & Mills, 2019, p. 2), and his principles of symbolic interactionism (Mead, 1932), a theory developed from the philosophy of pragmatism. In the late 1950s, Barney Glaser joined Anselm Strauss at the University of California, San Francisco, and during their work together, Glaser and Strauss worked out a methodology known as grounded theory (Corbin & Strauss, 2015). Since that time, Glaser and Strauss began interpreting the grounded theory principles differently and followed separate ways (Glaser, 1978, 1992, 1998, 2003, 2016; Strauss, 1987). The second generation of grounded theorists emerged in the 21st century's early years (Muller, 2012). Figure 10 presents the grounded theory's current classification (Rupsiene & Pranskuniene, 2010) with philosophical and methodological roots of classic grounded theory (Hadley, 2017).

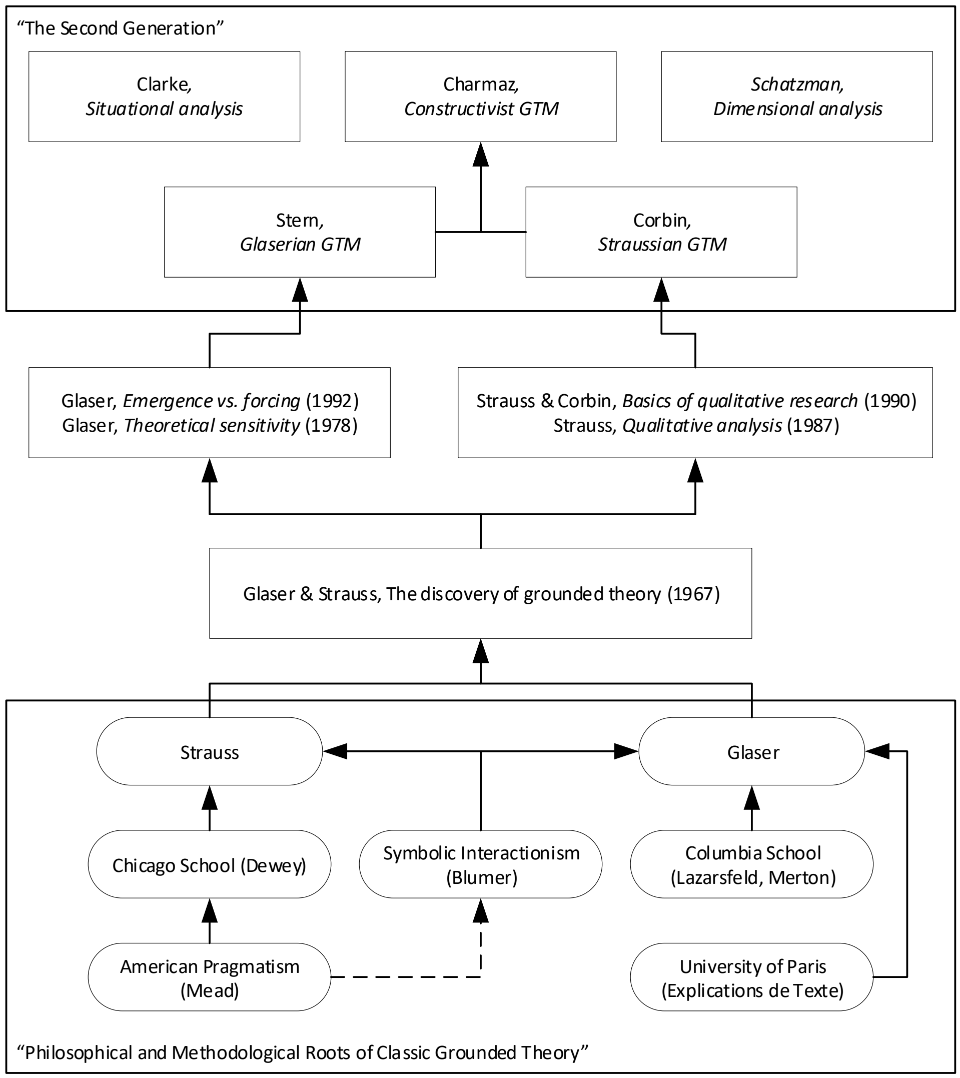

Figure 10 The classification of grounded theory (Rupsiene & Pranskuniene, 2010) with philosophical and methodological roots of classic grounded theory (Hadley, 2017)

In the *Discovery of Grounded Theory* (1967), sociologists Glaser and Strauss presented an alternative approach to scientific inquiry to generate theory from data collected in the field. Specifically, Glaser and Strauss (1967, p. 2) argued that in social research, generating theory goes hand in hand with verifying it; in other words, grounded theory is derived from data and then illustrated by characteristic examples of data.

Grounded theory is a strategy primarily associated with the qualitative school of inquiry (Given, 2008). Creswell and Poth (2018) included the grounded theory among the top five qualitative approaches to inquiry and between phenomenological research and ethnographic research. Grounded theory develops a theory grounded in data from the field rather than a phenomenological understanding of the essence of the experience or the ethnographic interpretation of a group's shared patterns (Creswell & Poth, 2018). Specifically, the concepts come from data collected during the research process; they are not chosen *before* beginning the research (Corbin & Strauss, 2015).

External critique of grounded theory

The criticism of the grounded theory mainly focused on the confusing terminology (Backman & Kyngäs, 1999), unnecessarily complicated method (Allan, 2003; Backman & Kyngäs, 1999; Boychuk Duchscher & Morgan, 2004; Greckhamer & Koro-Ljungberg, 2005), and an overemphasis on inductive reasoning (Harry, Sturges, & Klingner, 2005; McCann & Clark, 2003).

Charmaz (2006) addressed some of the above critiques, explaining that some critics never used grounded theory, cursorily read *The Discovery of Grounded Theory*, and are unaware of the grounded theory development over the past 50 years. Corbin and Strauss (2015) add that Glaser and Strauss clarified and updated many earlier claims. Birks and Mills (2015) address pragmatism and symbolic interactionism as the philosophies that methodologically underpin the grounded theory. Finally, Hadley (2017) offers an overview of several books that decipher the terminology and make the grounded theory more accessible.

Which branch of grounded theory: Glaserian or Straussian

From the outset, the grounded theory became more than the combined work of Glaser and Strauss (Walsh et al., 2015). Using the current methodological terminology, we might now talk of Glaser and Strauss each, acting as a lens that refracted diverse and profound traditions (both theoretical and methodological) towards the focal point of the grounded theory method (Bryant & Charmaz, 2007).

Many researchers tackled the difference between Glaserian and Straussian approaches to the grounded theory while conducting exploratory studies (Chun Tie, Birks, & Francis, 2019; Hadley, 2017; Kailah Sebastian, 2019; Locke, 2001; Makri & Neely, 2021; Suddaby, 2006). Alammar et al. (2019) provided a firsthand experience of grounded theory in practice by presenting several Ph.D. case studies. Work by Alammar et al. (2019) helps researchers make an informed decision in choosing between Glaserian and Straussian approaches. Alammar et al. (2019) discussed the main differences in their philosophical positions, the use of literature review, and the coding procedures (see Table 3 for more information). The literature review, and the worldview aspect of this research, are covered in the earlier sections. The following sections cover the other differences, including the coding procedures, the context definition, and the theory generation.

Table 3 Glaserian and Straussian approaches to the research at early stages (Adapted from Alammar et al., 2019)

	Glaserian approach	***Straussian approach***
Research problem		
General wonderment	Yes	Yes
Area of interest with no specific problem	Yes	Yes
Specific research problem	No	Yes
Research question		
General wonderment	Yes	Yes
Open research question	No	Yes
Narrow research question	No	Yes
Interview questions		
Unstructured	Yes	Yes
Semi-structured	No	Yes
Structured	No	No

After studying the works of many grounded theory scholars, this researcher decided on following the Straussian approach to the grounded theory as outlined by Corbin and Strauss (2015). The Straussian approach to completing the research allows for studying specific problems of the change in team development during Tuckman's adjourning phase induced by extrinsic events like mergers or joint ventures. A solution to such a problem informs the decisions made by teams leading the mergers of two or more companies under specific confidentiality conditions. Another area of implementation of such findings is monitoring the team development and providing an early warning to the team's manager. Narrow research questions necessary to complete the abovementioned studies are allowed under the Straussian approach to the grounded theory. Narrow research questions most likely require semi-structured interview protocols, also typical for the Straussian approach.

One of the most appealing elements of the Corbin and Strauss (2015) approach to the Straussian methodology is the precise structure of the steps and exhaustive explanation of what to complete at each step. This researcher incorporated this structure in the exploratory study of the potential changes to team development (see Appendix E and Appendix F for more information). While following structure could force the outcomes (Glaser, 1992, 2016; Walker & Myrick, 2006), it helped this researcher focus on the results and complete the study without "fighting" the method.

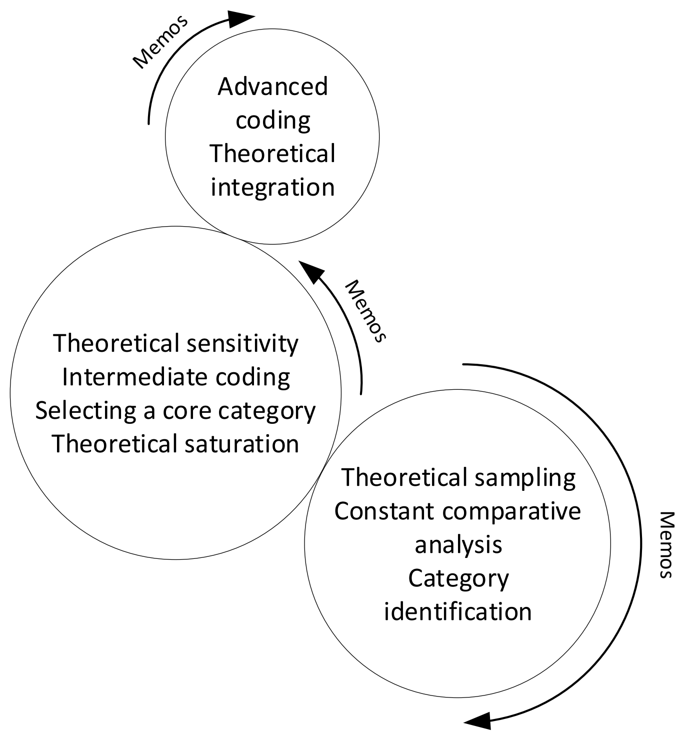

Figure 11 Essential grounded theory methods

Essential grounded theory methods

The SAGE Handbook of Grounded Theory (Bryant & Charmaz, 2007) lists numerous silent grounded theory research design characteristics. Birks and Mills (2015) include the following to constitute a set of essential grounded theory methods: writing memos; theoretical sampling; constant comparative analysis; category identification; theoretical sensitivity; intermediate coding, identifying core category; advanced coding, and theoretical integration. Figure 11 shows the most common interaction among the essential grounded theory methods described by Birks and Mills (2015). The following sections examined these methods while completing the mixed-methods design proposed for this exploratory study of potential changes to team development under extrinsic conditions like mergers or joint ventures.

The mixed methods-grounded theory approach

The mixed methods-grounded theory is emerging as a promising methodology intersecting the value of mixed methods with rigorous qualitative design (Birks et al., 2019; Castro, Kellison, Boyd, & Kopak, 2010; Guetterman, Babchuk, Howell Smith, & Stevens, 2019; Howell Smith et al., 2020). Howell Smith et al. (2020) stated that mixed methods and grounded theory are extraordinarily complementary and present several best practices for mixed methods-grounded theory study leading to a scale development for a new measurement model.

Table 4 presents the summary of the best practices by Howell Smith et al. (2020). In a similar study, Guetterman et al. (2019) discussed contemporary mixed methods-grounded theory research approaches. Sixty-one empirical mixed methods-grounded theory studies completed between 2012 and 2018 and included in the analysis allowed Guetterman et al. (2019) to establish a mixed methods-grounded theory checklist like the best practices list Howell Smith et al. (2020). Guetterman et al. (2019), Howell Smith et al. (2020), and Birks et al. (2019) are clear about following the principles of selected mixed-methods and grounded theory principles to achieve good results. The author incorporated Howell

Smith's best practices for conducting the mixed-methods research while using the grounded theory during the qualitative phase of the study.

Table 4 Best practices for Mixed Methods-Grounded Theory elements

Best Practices for Mixed Methods – Grounded Theory Element	*Evidence from this exploratory study dissertation*
Read and cite appropriate mixed methods methodological literature	Cites (Creswell, 2015; Creswell & Plano Clark, 2018; Schoonenboom & Johnson, 2017), among others
Read and cite appropriate grounded theory methodological literature	Cites (Corbin & Strauss, 2015; Glaser & Strauss, 1967; Strauss, 1987), among others
Ensure that methods match the research questions from both mixed methods and grounded theory perspective	Research questions call for exploration of an adjourning-like phenomenon (grounded theory) and the development of an instrument based on the grounded theory findings (mixed methods)
Describe the reasons for using mixed methods and specify which design	Specifies a sequential exploratory design with instrument development to capture [QUAL] and [QUAN] aspects of the phenomenon
Describe the reason for using grounded theory and specify which approach	Specifies the use of Straussian grounded theory to develop a theoretical model that would provide the foundation for the development of a new instrument
Identify and use the mixed methods procedures	Provides a procedural diagram and described methodological procedures throughout the study
Identify and use the grounded theory procedures	Describes the use of theoretical sampling, initial and axial coding, constant comparison, memoing, theoretical saturation, and the development of a theoretical model
Employ strategies for validating the grounded theory findings	Uses detailed description, clarifying researcher biases, peer review, and checklists

According to Tuckman's model, the area selected for this study is specific to the adjourning phase of team development (Tuckman & Jensen, 1977). The research questions guiding the qualitative strand of the study are open research questions (Bryman, 2007; Creswell & Plano Clark, 2018). This researcher followed a mixed methods-grounded theory design utilizing the exploratory sequential study (mixed methods) and Straussian approach (grounded theory) while exploring the adjourning phase of the team development phenomenon according to Tuckman’s model. The essential elements of the grounded theory methods are explained in the following sections.

Theoretical Sampling

Theoretical sampling distinguishes grounded theory and makes it much more than a coding system (Bryant & Charmaz, 2007). Theoretical sampling is open and flexible, allowing the researcher to follow the lead and focus data collection on areas best serving the developing theory (Corbin & Strauss, 2015). Additionally, Bryant and Charmaz (2007) recommend working with participants most likely to provide early insight. In other words, researchers deliberately seek participants that can add to the existing data set about a concept or category (Robinson, 2014).

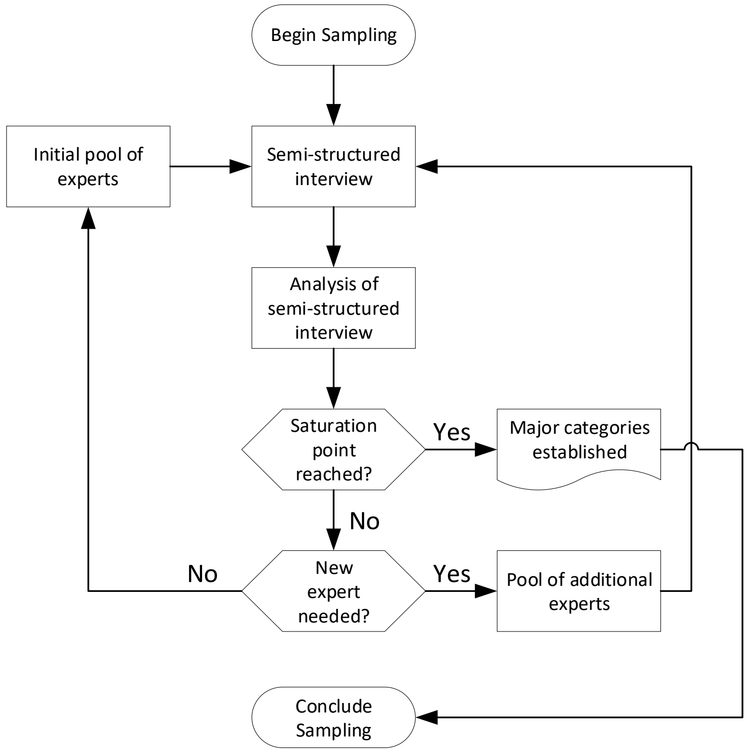

Figure 12 Diagram of a theoretical sampling of the qualitative strand utilizing the grounded theory principles

After collecting the first data, the analysis begins. The analysis leads to concepts, and concepts generate questions. Questions lead to more data collection, so more information is extracted about those concepts. Warren (2011) suggests that the theoretical sampling may continue through a "snowball" process: the participants in the study help to locate others through her their social networks (Biernacki & Waldorf, 1981). The process, presented in Figure 12, continues until reaching the desired level of category development, including its variation and integration (Corbin & Strauss, 2015).

According to Corbin and Strauss (2015), in grounded theory research, there is an identified population (in this case, members of the product development team) and a setting (in this case, firms and companies involved in metal forming and their suppliers). There are no other constraints on the population. The author followed such an approach and attained the flexibility to sample participants and settings based on concepts needing development (Buchanan & Bryman, 2009). The detailed information on the population and its settings is part of the study's context discussion presented in Chapter 4.

Temporal Aspects of Theoretical Sampling

The separate work periods designated for data collection, coding, and category identification are opposite to the theoretical sampling. Researcher aiming at discovering a theory fully engages in all three procedures concurrently and possible. Glaser and Strauss (1967) state that engaging in theoretical sampling without coding and analyzing simultaneously is impossible.

While Birks and Mills' (2015) diagram presented in Figure 11 includes the most common interaction among the essential grounded theory methods described, it does not indicate the temporal aspect of completing the grounded theory study. The author addressed this issue and created the temporal distribution of the mixed-methods research items representing the qualitative streak of the exploratory study on the potential change of the team members' behavior characteristics induced by the extrinsic event like a merger, joint venture, or technological change. The grounded theory essential elements like writing memos, theoretical sampling, constant comparative analysis, category identification, theoretical sensitivity, intermediate coding, identifying core category, advanced coding, and theoretical integration yielded the deliverables and scale development elements indicated in Figure 13. For example, the pilot study produced refined interview questions while reviews with the experts indicated the core set of instrument questions.

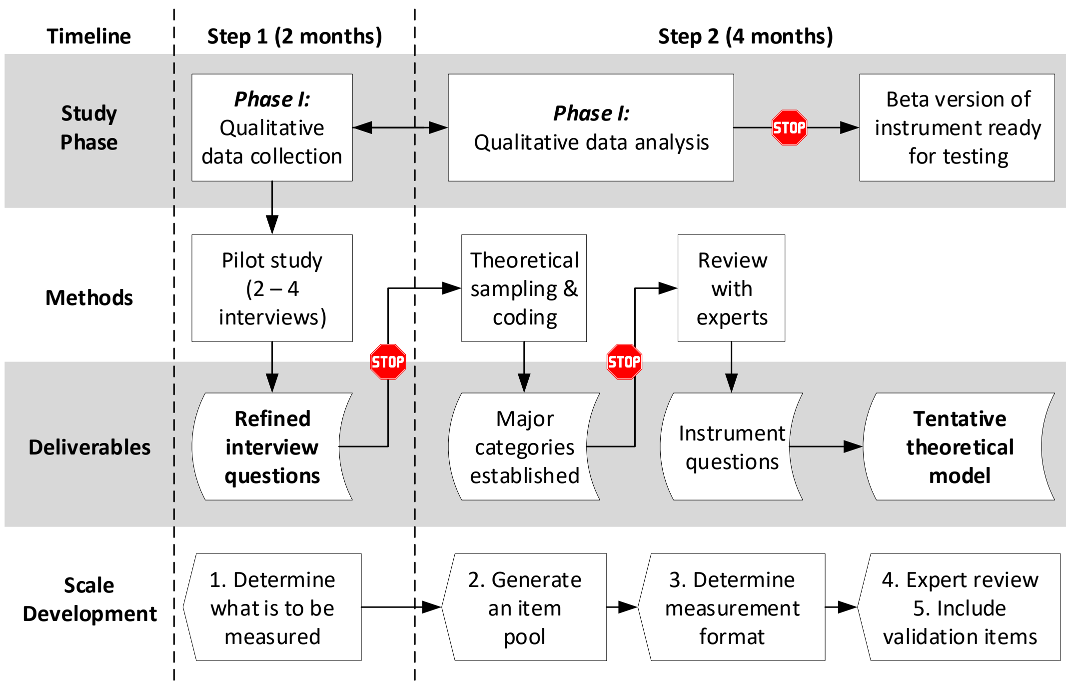

Figure 13 Temporal distribution of the mixed-methods research items representing the qualitative streak of the exploratory study

Selection of Participants

Time is critical for understanding teams; however, the teams' temporal stability is seldom the main focus of the published research (Gersick, 1992). The team tenure, defined as the amount of time a team has spent together (Stahl et al., 2010) and also known as the collective team tenure (Gonzalez-Mulé et al., 2019), could lead to smooth and automatic team performance (Jehn & Mannix, 2001). Furthermore, Stahl et al. (2010) and Gonzalez-Mule et al. (2019) indicate that it takes 3 to 4 years for a team to reach a high-performance level. Stahl et al. (2010) and Gonzalez-Mule et al. (2019) also indicate that team performance changes after reaching a high level of performance.

Of all qualitative methodologies, grounded theory is the most flexible about sample size as the project progresses (Corbin & Strauss, 2015; Robinson, 2014). This study utilized individual semi-structured interviews with members of the product development teams representing the light metal forming industry in the US (see Appendix C for the interview protocol details). The initial pool of experts selected for the semi-structured interviews included practitioners from this researcher's professional network. Selected practitioners represented various product development teams (or similar teams) from the US, had over ten years of experience in the manufacturing industry, were in the position to observe the team while it was performing during planned or spontaneous team dissolution resulting from the extrinsic conditions, and were willing to participate in this study (Given, 2008). The theoretical sampling process outlined in Figure 12 indicates locating additional experts to contrast with existing participants (Robinson, 2014) or new locations (Strauss, 1987).

The perception of external stimuli and thought produce memories – in other words, people remember information from external sources obtained through perception and internal processes like reasoning or imagination (M. K. Johnson & Raye, 1981, p. 67). In their seminal paper about *Reality Monitoring*, Johnson and Raye suggested that *"thinking about something may make it seem as though it was perceived more often than it actually was"* (1981, p. 67). Johnson and Raye also proposed that the pure sensory experience is impossible without some cognitive elaboration (1981, p. 67). Johnson and Raye concluded that the memory preserves the information about the origin of that information very well while the memory of the decisions made using this information is cognitively filtered, allowing for some error (1981, p. 82). Levine and Safer (2002) studied the sources of bias in memories. The studied bias suggested that emotions accompanying past events could distort the accuracy of reporting these events (Levine & Safer, 2002). Finally, people do not have infinite wetware in their brains to store all their memories (Landauer, 1986). The estimated brain wetware storage capacity is around 10^9 bits, affecting how much people remember. Some research suggests that even answering autobiographical questions could impact what and how well we remember (Bradburn, Rips, & Shevell, 1987; Christianson & Loftus, 1991; M. Ross & Wang, 2010; R. E. Smith, Leffingwell, & Ptacek, 1999).

This researcher selected participants who experienced significant external events while working with the product development teams and asked the participants to describe the events they remember the most vividly. Some participants did not hesitate and immediately started talking about the significant events. Other participants paused before offering an answer. All participants mentioned the emotions they experienced during the significant events. Interestingly, not all emotions were negative. Some participants indicated that the significant event offered an opportunity to rethink their situation and the possibility of advancing their careers by taking a “shortcut” enabled by the extrinsic events. All participants offered some qualification of their answers by saying *“as far as I remember”* or *“I remember it very well because ....”* This researcher coded their answers using *“positive”* and *“negative”* codes to capture the nature of the experience. This researcher also collected data about the time between the interview and the significant events; however, it was clear that the time between the interview and the significant events did not impact how each participant described them. In other words, this researcher did not detect the emotional distortion of the memory of the past events indicated by Levine and Safer (2002).

Moreover, the final section of the interview with the product development team members included questions about the participant’s thoughts about the topic selected for this research. This researcher wanted to know if the participants thought about the significant events and formulated their opinions about the team members' behavior before the interview. The participants admitted thinking about the past significant events from time to time, but they also admitted not being asked to formulate their opinions. This researcher believes that the study participants offered their best memory of the significant events and recognizes that the offered memories could be biased or tinted with the emotions experienced by the participants at that time. Conversely, such a bias could be typical for memories associated with significant events, thus affecting all study participants. Since it is impossible for this researcher to assess the degree of bias, he accepted the interview results and did not use codes for a long or short time since the last significant event.

Data Collection

The phrase *researcher-as-instrument* refers to the researcher as an active respondent in the research process (Hammersley & Atkinson, 1995). Sandelowski and Barroso (2003) conducted the qualitative meta-synthesis on a bibliographic sample of 99 works representing journal articles, books, technical reports, master thesis, and doctoral dissertations. The meta-synthesis findings are a foundation of a typology of qualitative findings (Sandelowski & Barroso, 2003). According to Sandelowski and Barroso (2003), the accurate representation of the study's method indicates methodological competence; however, it is not an indicator of its value. Marrow (2005) suggested that the qualitative research results' value could benefit from a statement about the researcher’s experience with the topic, any assumptions, expectations, and biases. The research report should also include information on how the investigator managed these items (Morrow, 2005).

The literature devoted explicitly to personal identity is relatively tiny, but the amount of literature dedicated to related questions is immense (P. Edwards, 1967). William James (1890) defined the self as a legitimate subject for scientific investigation. Since that time, research on the self has emerged in many social science fields, including psychiatry, psychology, social psychology, and sociology (Cooley, 1922; Zhao, 2015). When the researcher is part of the research and shares the participants’ experience (Berger, 2015), the reflective capacity of a human, leading to a self, is defined as “an empirical aggregate” of things subjectively known (Zhao, 2014), helps the researcher to demonstrate that their studies are credible (Creswell & Miller, 2000).

Researcher Positionality

This researcher is a product development professional currently with an international company. The researcher has more than 25 years of experience in research and development roles at higher education institutions and international companies, including multiple international team management positions for the past five years, supported by more than 30 publications, including peer-reviewed publications, book chapters, and several awards for various conference publications. As a result of this experience, this researcher has a unique perspective of product development team behavior during a steady performance state and the out-of-the-ordinary states induced by extrinsic conditions like mergers, joint ventures, or significant technological shifts.

To maximize the value of any research project, this researcher followed the principles of problem-solving techniques like Six Sigma DMAIC (Define, Measure, Analyze, Implement, and Control) (Mikel & Schroeder, 2000) or Total Quality PDCA (Plan, Do, Check, Act) (Imai, 1986). Specifically, this researcher did not jump the established procedure steps while often going back several steps within the established procedures. For example, this researcher followed the procedure of implementing an exploratory sequential mixed methods design proposed by Croswell and Plano Clark (2018), presented in Figure 9, without skipping any steps.

Ethical Considerations

According to O'Connor et al. (2008), grounded theory work is congruent with current IRB protocol if the research follows the established standards of grounded theory. Following the research's standards could help deal with dilemmas in which there are no ethical solutions except those resting on the ad hoc consent of all parties. Under federal regulations (45 CFR 46), all research involving human subjects must be reviewed or determined exempt by IRB to protect individual human participants. This researcher completed ethical research training offered by the Collaborative Institutional Training Initiative. The completed courses include Social & Behavioral Research, Social and Behavioral Responsible Conduct of Research, Humanities Responsible Conduct of Research, and Conflicts of Interest.

Respect for participants is one of the most critical aspects of this study (Swanson & Elwood, 2009). After completing and approving an IRB application, the potential participants received an informed consent form before starting the interview (see Appendix A). In addition to their signature, this researcher asked for the participant's permission to record the interview's audio. The participants received a signed copy of the consent form before the interview. This researcher assigned a numeric identifier to each participant to maintain their anonymity (Barrows & Clayto, 1996). The study participant's information and numeric identifiers resided on one computer while the interviews and the related analysis results were stored separately.

Methodological journal

Some grounded theory scholars advise keeping a methodological journal for jotting down methodological dilemmas, directions, and decisions. Charmaz (2014, p.165) recommends keeping a methodological journal to *"engage in reflexivity and … avoid preconceiving … data,"* while Corbin and Struss (2015, p. 119) add that *"it is helpful to do periodic self-reflection and keep a notebook … separate from memos, to record feelings, impressions, and responses during the research process."* A reflective journal for reflection-on-action (Dunlap, 2006), a double-entry journal for writing quotations from a text and responding to them, a metacognitive journal for discussing one's thinking and learning, a synthesis journal for application in a practical setting, and a freewriting journal are just a few examples of journals types (Liuolienė & Metiūnienė, 2009; Whited & Trujillo, 2005).

Corbin and Strauss (2015, p.119) advised periodic self-reflection and keeping a journal separate from memos to record feelings, impressions, and responses during the research process. Connor-Greene (2000) studied students' writing assignments and concluded that journal writing enhanced students learning. Specifically, as the students participating in the Connor-Greene study stated, journal writing fostered understanding and application of concepts (Connor-Greene, 2000). Dunlap (2006) added that encouraging student reflection gives students a voice. That voice allows students to describe – in their own words – the reasoning changes encountered during the research process (Dunlap, 2006). The reflective quality of journaling is one of the most often researched aspects of journaling as a learning tool (Horton, Gibson, & Curington, 2021; Liuolienė & Metiūnienė, 2009; Oliver, Shenkman, Diewald, & Smeltzer, 2021).

This researcher followed Corbin and Strauss's (2015, p.119) advice and kept a journal during the project. The initial journal entries date back to 2019, when the researcher narrowed the scope of work. The scanned journal pages were periodically imported into the NVivo 12 project devoted to this study and coded using the latest codebook, enhancing the analysis and conceptualization processes.

Instrumentation

Cassell (2011) stated that the universal data collection technique is the interview. Interviews can generate quantitative and qualitative data and are a staple of many textbooks on organizational research methods (Cassell, 2009). There are many ways to use interviews in organizational research (Buchanan & Bryman, 2009). Atkinson and Silverman (1997, p. 304) suggested that *"the open-ended interview offers the opportunity for an authentic gaze into the soul of another,"* making it attractive to a wide range of researchers.

Extensive usage of interviews produced different types of interviews in organizational research (Bryman & Bell, 2007; Buchanan & Bryman, 2009; Cassell, 2009; N. King, 2004; Kvale & Brinkmann, 2015). The practical considerations when organizing an interview are (1) the interview structure, (2) medium, location, and interviewee selection, and (3) underlying epistemological assumptions (Cassell, 2009, p. 505). The structure built into an interview determines its type as unstructured, semi-structured, and structured interviews (Buchanan & Bryman, 2009). In qualitative approaches, interviews are semi-structured or unstructured, encouraging interviewees to talk about the subject and shaping the interview direction (Cassell, 2009). Corbin and Strauss (2015) stated that unconstrained interviews provide the richest data source for theory building. Kvale and Brinkman (2009) added that the qualitative research interview is *“an attempt to understand the world from the subject’s point of view … to uncover their lived world”* (p. 2).

Typically, interviews are conducted face-to-face or via telephone (Bryman & Bell, 2007; Cassell, 2009). The computer-based communication tools and easier access to the Internet provides additional interview techniques (Opdenakker, 2006). Microsoft Skype (Alkhateeb, 2018; Janghorban, Roudsari, & Taghipour, 2014) and Zoom Videoconferencing (Archibald, Ambagtsheer, Casey, & Lawless, 2019) are examples of computer-based communication tools as medium for the qualitative interview. Archibald et al. (2019) asked sixteen nurse practitioners about Zoom's interview experience. Most nurses described their interview experience as highly satisfactory and rated Zoom above face-to-face and telephone interviews. Archibald et al. (2019) and Sedgwicks and Spiers (2009) agreed that Internet connection speed and previous experience with software like Microsoft Skype or Zoom improves interviewees' satisfaction.

Impact of COVID-19 on the selected instrument

The COVID-19 pandemic is unprecedented, impacting all personal and professional life facets. Video interviewing for residency programs (Joshi, Bloom, Spencer, Gaetke-Udager, & Cohan, 2020) and an increase in video consultations (Jiménez-Rodríguez et al., 2020) are just a few examples of the rapidly growing use of videoconferencing during the COVID-19 pandemic. The pandemic created a significant supply shortage of personal protective equipment (World Health Organization, 2020) and changed the rules for on-site visits (Shah, Emlen, Mayer, Scrimenti, & Hidalgo, 2020), impacting how firms operate and cooperate (Peiro-Garcia et al., 2020).

This researcher completed the semi-structured interview using MS Teams video conferencing software. The semi-structured interview is a well-established tool in organizational research (Bryman & Bell, 2007; Given, 2008), encouraging interviewees to talk at length about the subject (Cassell, 2009) by asking subjects how they see others in different social situations (N. King, 2004). Moreover, the Straussian approach to the grounded theory embraces semi-structured interviews (Strauss, 1987), while the Glaserian approach advocates for unstructured interviews (Glaser, 1998).

The COVID-19 pandemic almost eliminated the on-site access for face-to-face interviews (Shah et al., 2020); therefore, semi-structured interviews using videoconferencing software were well-rooted in the organization research methods like the grounded theory, under various travel restrictions, an ethical approach as well. Mitigating the risk of spreading COVID-19 is a shared responsibility (Kliger & Silberzweig, 2020), and finding alternative or innovative solutions like videoconferencing (Opdenakker, 2006) is just one of many examples of how to adopt CDC guidelines for COVID-19 virus spread prevention (Openshaw & Travassos, 2021) while conducting the research.

Procedures

Creswell and Poth (2018) viewed interviewing as a series of steps in the procedure. Kvale and Brinkmann (2009) established seven stages of an interview inquiry following a logical sequence. Rubin and Rubin (2012) proposed a similar seven-step sequence called the responsive interviewing model. This model is more flexible than the procedure by Kvale and Brinkmann (2009), allowing the researcher to change the questions asked, the sites chosen, and the situations to study. These characteristics align with the interviewing in theoretical sampling, where new lines of inquiry in later interviews reflect the researcher's developing analyses (Brinkmann & Kvale, 2018; Bryant & Charmaz, 2007; Kvale & Brinkmann, 2015).

Creswell and Poth (2018) combined the methods of Kvale and Brinkmann (2009) and Rubin and Rubin (2012) into a procedure for conducting interviews. Figure 14 presents a procedure adapted from the original procedure proposed by Creswell and Poth (2018). The adaptation replaces the purposeful sampling procedure with theoretical sampling necessary for completing the grounded theory steps. After receiving the IRB approval and consent from the interviewee (see Appendix A for a copy of the informed consent form), this researcher followed the steps outlined in Figure 14 while conducting the pilot test. Using a structured approach to the pilot test helped identify potential problems and fix them (Glaser, 1978); before starting the actual theoretical sampling procedure presented in Figure 12. The first interview in this study provided an invaluable opportunity to test the interview procedure, adjust it accordingly, and implement it during the second interview, saving time and resources required for this study phase.

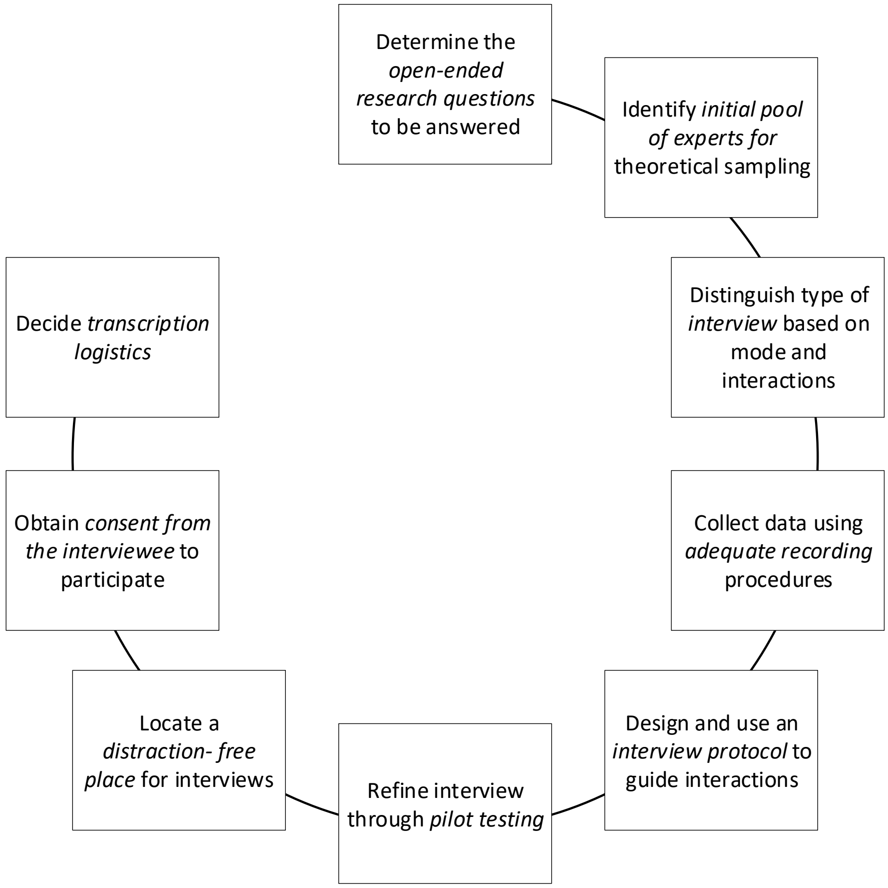

Figure 14 Procedures for preparing and conducting interviews (adapted from Creswell & Poth, 2018)

Interview Protocol

Charmaz (2014) advised framing the questions to help understand the experience from the participant's view and encourage elaboration. Glaser and Strauss (1967) stated that listening to respondents recounting their stories is prominent during the research's early stages. Therefore, interviewing could begin in an open manner seeking the respondent's perspective on the phenomena (Wimpenny & Gass, 2000). The ongoing data analysis, characteristic of the grounded theory method, could lead to a tentative theory's emergence, including the categories possibly providing a focus for subsequent interviews (Strauss, 1987). Analytical questions and initial hypotheses could guide subsequent interviews about these categories and their relationships (Corbin & Strauss, 2015). Establishing and following interview rigor supports methodological congruence in the review process (Burns, 1989).

Several researchers indicated that the pilot study (Puerta, 2008) and a limited number of initial open-ended questions (Burns, 1989; Clarke D.J., 2007; Manuel, 2016; Puerta, 2008) provide richer data and faster emergence of themes during the data analysis. Appendix C contains an example of an interview protocol envisioned for the initial 2 to 4 interviews. The questions were created by following guidelines proposed by Charmaz (2014) and served as a foundation for the pilot test. The iterative process of grounded theory allows for new inquiry lines in later interviews that reflect the developing analyses (Charmaz, 2014, p. 103). Indeed, this researcher adjusted the interview protocol after the first interview and used the adjusted version during the remaining interviews.

As stated earlier in this chapter, to maximize the value of any research project, this researcher followed the principles of problem-solving techniques like Six Sigma DMAIC (Define, Measure, Analyze, Implement, and Control) (Mikel & Schroeder, 2000) and Total Quality PDCA (Plan, Do, Check, Act) (Imai, 1986). Specifically, this researcher used the DMAIC way of the root cause analysis and applied the “drill down” approach to encourage the interviewees to provide more details on the specific aspects while describing the potential changes observed in the team members' behavior during extrinsically induced events. Qu and Dumay (2011) stated that *"interviews provide a useful way for researchers to learn about the world of others, although real understanding may sometimes be elusive."* The drill-down approach was a way to reduce elusiveness and make the answers more tangible, thus easier to define and potentially measure. Using the drill-down approach, the communication between interviewer and interviewee becomes less complicated even when these people do not share the worldview (Qu & Dumay, 2011).

How many interviews?

There is no one answer to *"how many qualitative interviews is enough?"* Baker and Edwards (2012) compiled the voices of many renowned social scientists and concluded that most answers were *"it depends."* The nature of research, the focus and the objectives of the analysis, the time available, and the institutional committee requirements are the most often cited limitations on the feasible number of interviews (S. E. Baker & Edwards, 2012, p. 42). Most of the social scientists approached by Baker and Edwards (2012) suggested defining the saturation level adequate for the research as a guiding principle in determining the number of semi-structured interviews.

On the other side of the social scientists' spectrum are researchers providing some guidelines on the number of interviews. Hennink et al. (2017) indicated nine interviews, and Guest et al. (2006) found that six interviews were enough to reach the codes saturation in their research. Reaching meaning saturation required twice as many interviews (Guest, Bunce, & Johnson, 2006; Hennink, Kaiser, & Marconi, 2017). Galvin (2015) went a step further and proposed a formula for probability R that the theme will emerge in a separate interview:

$$R = 1 - e^{\frac{\ln(1-P)}{n}} \qquad (1)$$

where P is a confidence level and n the number of interviews. For example, we would need ten interviews if we are 95% confident that at least one person will mention a theme held by at least 25% of the population (Galvin, 2015).

This researcher followed the Straussian approach to conducting grounded theory research. Strauss (1987) did not propose an exact number of interviews to reach the desired saturation level. Strauss (1987), like other social scientists (Becker, 2007; Buchanan & Bryman, 2009; Charmaz, 2014; Denzin & Lincoln, 2005; Flick, 2018; Oliver, D; Serovich, J; Mason, 2005), indicated that the number of interviews depends on how well the consecutive interviews build on the information from previous interviews about categories and their relationships. This researcher followed Strauss's (1987) advice and used the tools available in NVivo 12 to track the number of new codes and coding to the existing codes as a proxy to the coding saturation. This researcher also used his familiarity with the subject and information found in the interviews to decide when more interviews are no longer needed to satisfy the main objective of this exploratory study.

Preparing data to code

A researcher needs to collect data before conducting qualitative coding or analysis (Adu, 2019). This researcher obtained permission to record the interviews. During the study, the audio files resided in a location different from the files' location, enabling the identification of the interviewees and maintaining confidentiality.

This researcher manually transcribed the interview audio files to preserve the morphologic naturalness of transcription (McLellan, MaCqueen, & Neidig, 2003). Such a transcription style is known as denaturalized transcription (Bucholtz, 2000) and is present in studies involving grounded theory and critical disclosures analysis (Davidson, 2009; Oliver, D; Serovich, J; Mason, 2005). Moreover, manual transcription furthers the interviewee's identity protection (J. Da Silva, 2021) and offers a unique opportunity to deep dive into the data.

Gersick (1989) proposed a new group development model – a punctuated equilibrium model – using data gathered for her dissertation. While writing about Gersick's accomplishments, Hackman stated that she had worn the paint off the play and rewind keys on the recorder she borrowed from him (Beyer, 1992, p. 73). Nevertheless, it demonstrates the dedication and a potential need for constant returning to the data for more information. This researcher demonstrated a similar determination in analyzing data gathered during semi-structured interviews.

Data Analysis – Coding

Coding is the grounded theory's core process of analyzing data (Bryant & Charmaz, 2007; Walker & Myrick, 2006). *"A code is an abstract representation of an object or phenomenon"* (Corbin & Strauss, 2015, p. 66), and it *"is most often a word or a short phrase that symbolically assigns a summative, salient, essence-capturing and evocative attribute for a portion of language-based or visual data"* (Saldana, 2016 p. 4). Strauss (1989) calls codes *"relevant portions of data to help address the research problem."*

Constant comparison is a fundamental feature of grounded theory and requires the researcher to engage in data interpretation simultaneously as the data are collected (Buchanan & Bryman, 2009). The search for similarities and differences and triangulation to cross-check emergent findings leads to the presentation of grounded theory beyond thick description instead of explaining the phenomenon under study (Bryant & Charmaz, 2007; Carter, Bryant-Lukosius, DiCenso, Blythe, & Neville, 2014; Given, 2008; Glaser, 1998; Strauss, 1987).

Open coding is the initial step in the coding process with Glaser (1978) and Strauss (Strauss & Corbin, 1990). To Strauss and Corbin (1990), open coding is the first step in the three phases *"analytic process through which concepts are identified and their properties and dimensions are discovered in the data"* (p. 101). At this stage, the researcher uses several specific analytic tools, like questioning, analysis of a word, phrases, or sentences, the flip-flop technique, making close-in and far-out comparisons to achieve the theoretical saturation point (Corbin & Strauss, 2015).

The axial coding is the second of Strauss and Corbin's (1990) three-phase method. The axial coding is crucial for the Straussian approach and is not present in the Glaserian approach. During this phase, the researcher is working on understanding categories related to other categories and their subcategories while focusing on three aspects of the phenomenon. These aspects are (1) conditions or situations in which phenomenon occurs; (2) actions or interactions of the people in response to what is happening in the situations; and (3) consequences or results of the action taken or inaction (Corbin & Strauss, 2015).

The final phase focuses on integrating the data around a central theme, hypothesis, or story to generate a theory (Walker & Myrick, 2006). Selective coding, according to Corbin and Strauss (2015), is the *"process of integrating and refining the theory"* (p. 143). To accomplish this final task, the analyst selects a core category and then relates all other categories to the core and the other categories (Walker & Myrick, 2006). Selective coding is similar to axial coding, in which the developed categories have defined properties, dimensions, and relationships, except that the integration occurs at a more abstract level of analysis (Corbin & Strauss, 2015; Walker & Myrick, 2006). The ultimate goal is a theory that integrates with existing theories showing the relevance and new perspective (Bryant & Charmaz, 2007, p. 383).

Software applications

Quantitative and qualitative software packages help researchers analyze data for years (Creswell & Plano Clark, 2018). For example, the current version of NVivo, based on the work of Lyn and Tom Richardson, debuted in 1981 (Jackson & Bazeley, 2019; Richards, 2011). Qualitative software packages generally offer a range of functions for memoing, coding, filtering for comparison, co-occurrence evaluation, and diagramming (Given, 2008). NVivo data management and searching program include tools for managing data and ideas, querying and visualizing the data, and reporting (Jackson & Bazeley, 2019, p. 9). Other software for qualitative research, similar to the NVivo package, include MS Word, MS Excel, ATLAS.ti, QDA Miner, and MAXQDA (Adu, 2019).

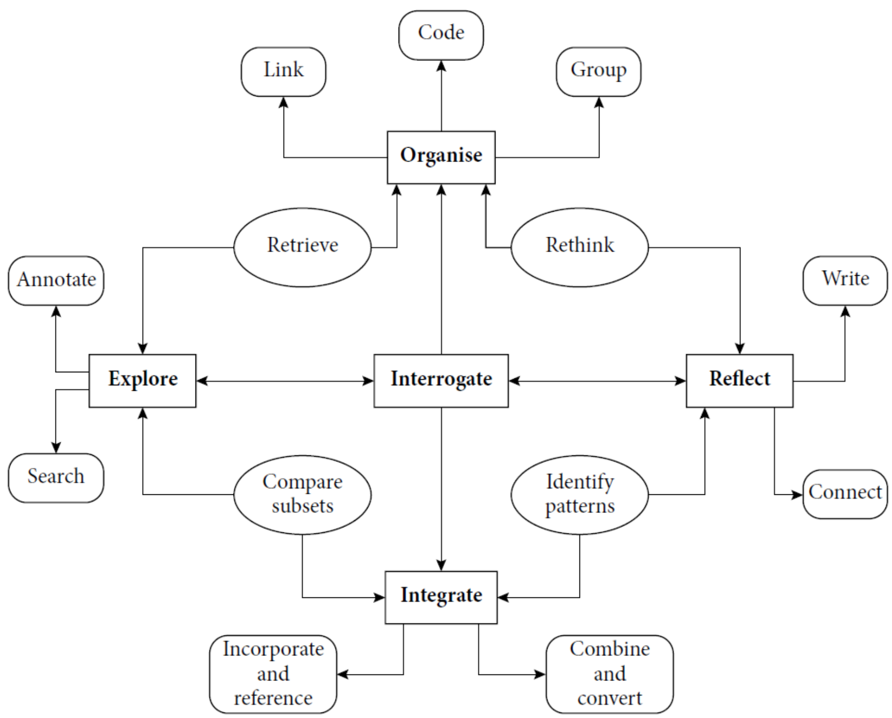

Figure 15 Qualitative activities and software tools (Silver & Lewins, 2014)

Silver and Lewins (2014) develop a framework of five analytic activities independent of methodology to develop analytical plans that connect the project's objectives with the detailed tasks. Figure 15 shows a network of qualitative activities and software tools proposed by Silver and Levin (2014). Data interrogation serves as a hub for data organization, exploration, integration, and reflection (Silver & Lewins, 2014). Such an approach could suit many projects, including the grounded theory project. The three dimensions for each of the above activities (i.e., link, code, and group for data organization) are tasks completed using software like NVivo.

NVivo 12

Therefore, this researcher used NVivo 12 to support the research activities while conducting the mixed-methods exploratory investigation of the adjourning phase behavior in a product development team sample. Incorporating the five analytic activities framework by Silver and Lewins (2014) into NVivo 12 could further improve the methodological accuracy of the method with a possible positive impact on the quality of the results. The use of NVivo 12 included visualization of ideas in a Mind Map and assumptions in a Concept Map, writing annotations, developing memos, connecting memos with relevant sections of the interview transcript via a Memo Link, creating a web of connections between evidence and ideas through See Also Links, and relating data or ideas to items outside of the project with a Hyperlink (Jackson & Bazeley, 2019).

Software tools like NVivo 12 are like the pencil, highlighter, and filing cabinet, enabling different ways of looking at and catting through the data while allowing flexibility and thoroughness impossible for their "manual" counterparts (Silver & Lewins, 2014, p. 34).

Some competence in using the software tools is necessary for the appropriate use of NVivo 12. Specifically, the researcher did not use the auto coding function and completed all coding steps manually. This researcher followed Corbin and Strauss's (2015, p.205) advice that *"analysis is about thinking, and thinking is the one thing the computer cannot do yet."*

Bracketing

As stated in Chapter 2, using literature represents a contentious and divisive issue within grounded theory research (Dunne, 2011). Glaser and Strauss (1967) initially argued explicitly against using literature. Since the initial publication of Glaser and Strauss in 1967, the debate on the literature review position shifted from not doing it to when complete it and how extensive it should be (Cutcliffe, 2000; McGhee et al., 2007).

Similarly, the role of previous knowledge is one of the central themes when qualitative scholars, researchers, and practitioners are discussing the differences between phenomenological and grounded theory methods (Ahern, 1999; Backman & Kyngäs, 1999; C. Baker, Wuest, & Noerager Stern, 1992; Berger, 2015; Bryant & Charmaz, 2007; Burns, 1989; Gearing, 2004; Morrow, 2005; Poland, 1995; Rennie, 2016; Tufford & Newman, 2012; Wimpenny & Gass, 2000).

Ahern (1999) defined bracketing as a *"means of demonstrating the validity of the data collection and analytic process,"* possibly increasing the reader's ability to assess the validity of studies. In an excellent review of bracketing in phenomenological research, Gearing (2004) extended the bracketing definition and proposed a typology of bracketing comprising six forms of bracketing, specifically *"ideal, descriptive, existential, analytic, reflexive, and pragmatic"* (p. 1448). In a more practical approach, Tufford and Newman (2012) defined bracketing as a method to mitigate the effects of preconceptions that may impact the research process.

Baker (1992, p. 1357) discussed the role of previous knowledge by contrasting phenomenology and grounded theory. In phenomenology, the researcher must bracket or suspend what they already know about the experience under evaluation, while grounded theorists take the opposite position and do not put aside ideas and assumptions about the situation they study. It does not mean that the grounded theorist should not acknowledge personal bias. The grounded theorist should recognize the possibility of bias and, if necessary, discuss the situation under which the bias weighed on the results. Rennie (2016) argues that Glasser and Strauss incorporated in their approach *"the phenomenological technique known as bracketing,"* helping the investigator to focus attention on data. In other words, despite its phenomenological origin (Gearing, 2004), the bracketing should be included in the grounded researcher toolbox (Adu, 2019, pp. 72–83).

As indicated earlier in this chapter, this researcher followed the Straussian approach and used bracketing in several situations to indicate the potential of personal bias while working with data. This researcher used the methodological journal to collect the research work's thoughts and ideas. Most of the researcher's methodological journal entries are summaries following individual research steps like literature search on a specific topic, finishing individual interviews, or adding topics to the future research topics' list.

Since most of the methodological journal entries were personal and possibly biased, the researcher created a "Personal Bias" code indicating information tinted with personal bias.

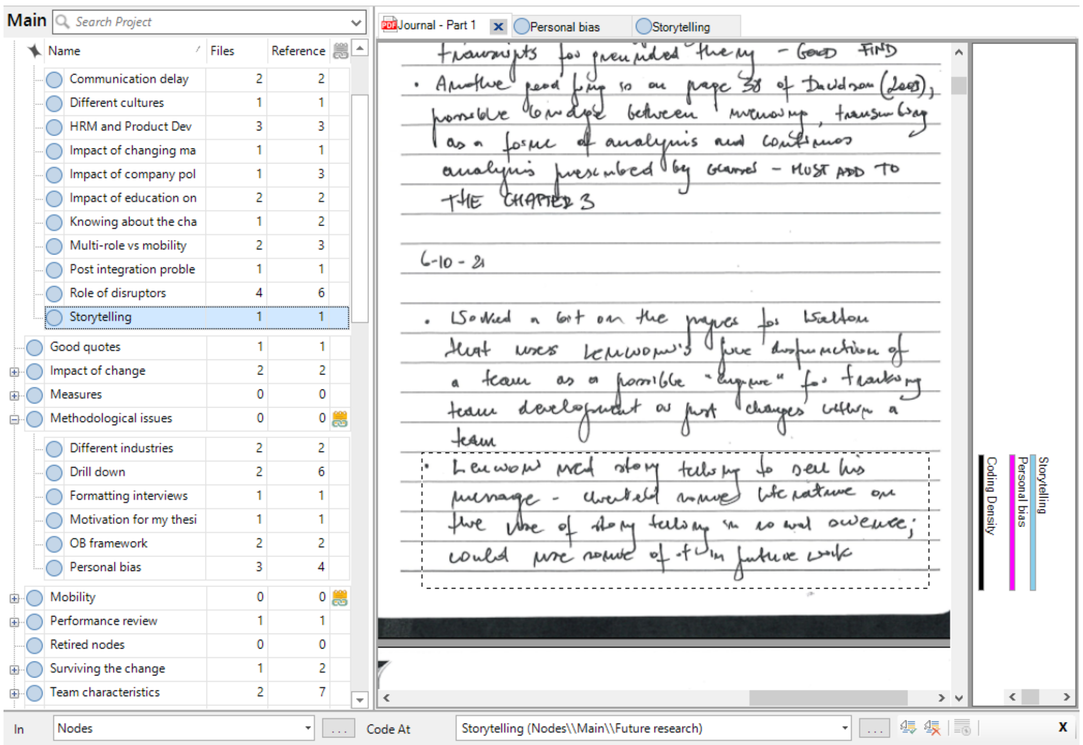

Figure 16 NVivo window showing the methodological journal entry coded with "Personal bias" and "Storytelling"

Figure 16 illustrates how the researcher used NVivo 12 and coded a part of the methodological journal entry using two codes, "Storytelling" and "Personal bias." The journal entry states that *"Lencioni used the storytelling to sell his message."* That June 6, 2021, journal entry followed the reading of "The Five Dysfunctions of a Team" by P.

Lencioni (2012). The author noted that *"Lencioni used storytelling to sell his message"* and *"checked some literature on the use of storytelling in social science."* The "Personal bias" code was used to code the first quote and the "Storytelling" code to code the second quote in the previous sentence. Such a process of adding the "Personal bias" code promotes self-awareness (Adu, 2019, p. 73), intensifies engagement with the data (Charmaz, 2014), and contributes to the credibility of the findings (Tufford & Newman, 2012).

Writing memos

In qualitative research methodologies, memo writing is one of the few data analysis techniques recommended by the majority of grounded theory scholars (Birks, Chapman, & Francis, 2008; Boychuk Duchscher & Morgan, 2004; Bryant & Charmaz, 2007; Charmaz, 2014; Clarke D.J., 2007; Corbin & Strauss, 2015; Glaser, 2014; Glaser & Strauss, 1967; Lempert, 2006). Often seen as a time-consuming chore (Chenitz & Swanson, 1986, p. 108; Corbin & Strauss, 2015, p. 118), memos are written records of a researcher's thinking while undertaking a grounded theory study (Birks et al., 2019). Memos begin as a rudimentary representation of thought and grow in complexity, density, clarity, and accuracy as the research progresses (Corbin & Strauss, 2015). The novice and experienced researchers can effectively employ memos as a procedural and analytical strategy to keep track of qualitative analysis (Birks et al., 2008).

Glasser (2014, p. 44) indicates that memos start when the researcher begins collecting data. Moreover, Glasser (2014, p. 45) states that memoing should take momentary priority over everyday activities, so the “a-ha” moments and instantaneous ideas receive a written closure. Once written, they could serve as a base for further exploration and analysis. Glasser (2014, p. 45) also adds that there are no rules on what to write about and that the use of other researchers’ lists of what memos should include is burdensome. Similarly, Birks et al. (2008) suggest that while there are some guidelines for writing memos, memoing remains a flexible strategy. Memo-writing and its content depend on the researcher’s preferences and the nature of the study (Corbin & Strauss, 2015, p. 119).

The grounded theory scholars like Glaser (2014), Corbin and Strauss (2015), and Charmaz (2014) write that the initial memos by the novice researcher are short and diluted before becoming much longer and focused on data to illustrate the emerging concepts. Not all authors agree with this statement. In 1997, Orona published the grounded theory study results on temporality and identity loss due to Alzheimer’s disease among team members of an Adult Day Health Center for physically and mentally impaired elderly. Surprisingly, Orona (1997) stated that the memos *“did not get better over time.”* Instead, the memos helped unblock the researcher or crystallize a conceptualization (Orona, 1997, p. 181). In other words, Orona (1997) used memos for data analysis in several ways in various phases of the research.

As indicated earlier in this chapter, this researcher followed the Straussian approach to data analysis while conducting a grounded theory study (Alammar, Intezari, Cardow, & Pauleen, 2019; Corbin & Strauss, 2015; Strauss & Corbin, 1997). This researcher created over one hundred dated memos to keep track of developing the theory based on systematically collected data. Each memo had a conceptual heading for easier cross-referencing and, as recommended by Chenitz and Swanson (1986, p. 108), and, in most cases, included a summarizing statement of what triggered the memo (Chenitz & Swanson, 1986). The handwritten memos were scanned into NVivo 12, while other memos, typed using NVivo 12, served as the material to write up the final theory

Corbin and Strauss (2018) proposed a set of checkpoints for researchers and reviewers to evaluate the methodological consistency of a grounded theory study. The list, presented in Appendix E and followed by the author, includes a checkpoint on memos while conducting the data analysis. By writing memos as described in this section and following rules of thumb for memo sequencing proposed by Strauss (1987, p. 211), this researcher assured the methodological consistency between this report, and the grounded theory guidelines for data analysis were congruent with the Straussian approach to completing the grounded theory research.

Theoretical integration

Integration is the final technique in theory-building while following the Straussian approach to the grounded theory. The main objective is to find a common denominator for discovered concepts. The concepts alone do not make a theory, like the ribs alone do not constitute the umbrella. A pole supporting the ribs and the canvas covering the ribs are needed to make an umbrella capable of protecting oneself from the rain. Similarly, concepts must be linked and filled with details to construct a dense and explanatory theory (Corbin and Strauss, 2015, p. 188).

The common denominator, also called the core category or concept, represents the central theme of the research as determined by the researcher. The emergence of the central theme representing all participants in the study and having the most explanatory power is extremely difficult without an unbiased analysis of data found in the semi-structured interviews described earlier in this section. Additionally, the author embraced memo writing as suggested by many grounded theory scholars (Birks et al., 2008; Charmaz, 2014; Corbin & Strauss, 2015; Glaser, 2014; Lempert, 2006; Strauss & Corbin, 1997), achieved sufficient theoretical saturation and used the integrated information to create the theoretical memos thus creating a foundation for the theory writing (Corbin & Strauss, 2015, p. 189).

Moreover, this author used the Straussian approach to the exploratory study of team development during the externally induced adjournment phase and utilized Strauss's (1987, p.36) list of criteria for choosing a core category (see Appendix G for a complete list of criteria).

Diagrams and visual displays

Diagrams enhance the presentation of the findings and simplify the narration of results (Adu, 2019, p. 167). To support the use of visual displays in qualitative studies, Scagnoli and Verdinelli (2017) suggested four critical features of visual display: (1) communication and additional value, (2) logical and coherent structure, (3) aesthetics, and (4) simplicity. Diagrams should contain just the right amount of information and balance the information already included in the text (Allen, 2018; Rubinson, 2019; Scagnoli & Verdinelli, 2017).

Despite their potential benefit for understanding conceptualization (Buckley & Waring, 2013; Clarke, Friese, & Washbourn, 2016), diagrams remain underutilized in the analytical process (Scagnoli & Verdinelli, 2017). Buckley and Waring (2013) explored some intricacies associated with the use of diagrams in grounded theory and concluded that *"diagrammatical representation can offer researchers invaluable resources while conceptualizing and representing complex data sets"* (p. 168). Charmaz (2014) stated that *"diagrams can offer concrete images of our ideas"* and that many grounded theorists see creating visual displays of the emerging themes and theories as an intrinsic part of grounded theory methods (p. 218).

Additionally, diagrams are another aspect of the grounded theory methodology besides the literature search and bracketing that divides the grounded theory scholars (Bryant & Charmaz, 2007, p. 23). Corbin and Strauss (2015) embraced the use of diagrams since *"they help researchers explain their findings … in very systematic and organized ways"* (p. 123), while Glaser wants to know what the diagram means, implying writing about it (Glaser, 1992, 1998, 2003). This researcher follows a Straussian approach to the grounded theory; therefore, numerous charts, maps, diagrams, flow charts, and unique visual displays will support the information presented in each chapter of this dissertation.

Code mapping

Code mapping is a practical application of data visualization or a qualitative data display (Saldana, 2016, p. 218). As mentioned in earlier sections, the author incorporated many tools to visualize the data and support its integration, including a structured process methodology (Brethauer, 2002, p. 45), visual aids (Pike, 1994, p. 41), and guided imaginary script (Justice & Jamieson, 1999, p. 184). The author used these tools while conducting various problem-solving activities involving capturing, recording, sorting, and evaluating data coming from multiple sources. Instead of using these tools manually (Post It® Notes, flip charts, or whiteboards), the author used NVivo 12 and adopted tools like Maps to visualize the process structure and extended Codes structure into a taxonomic tree diagram.

Following the Straussian approach to completing this exploratory study and enabling constant comparison, the author created several maps reflecting the study design presented in this section, including the initial study design shown in Figure 17. Each element presented in Figure 17 is an active and clickable element linked with other items in the NVivo 12 document representing this study. To achieve coherent linking and avoid a complex web of relating everything to everything, the author used NVivo 12 function called *"Sets."* Sets are collections of project items (Adu, 2019; Jackson & Bazeley, 2019; Saldana, 2016) and can contain various project items like data files, codes, cases, PDF files, and audio files. Sets are very convenient for organizing several project items and representing them as a single item on maps or diagrams.

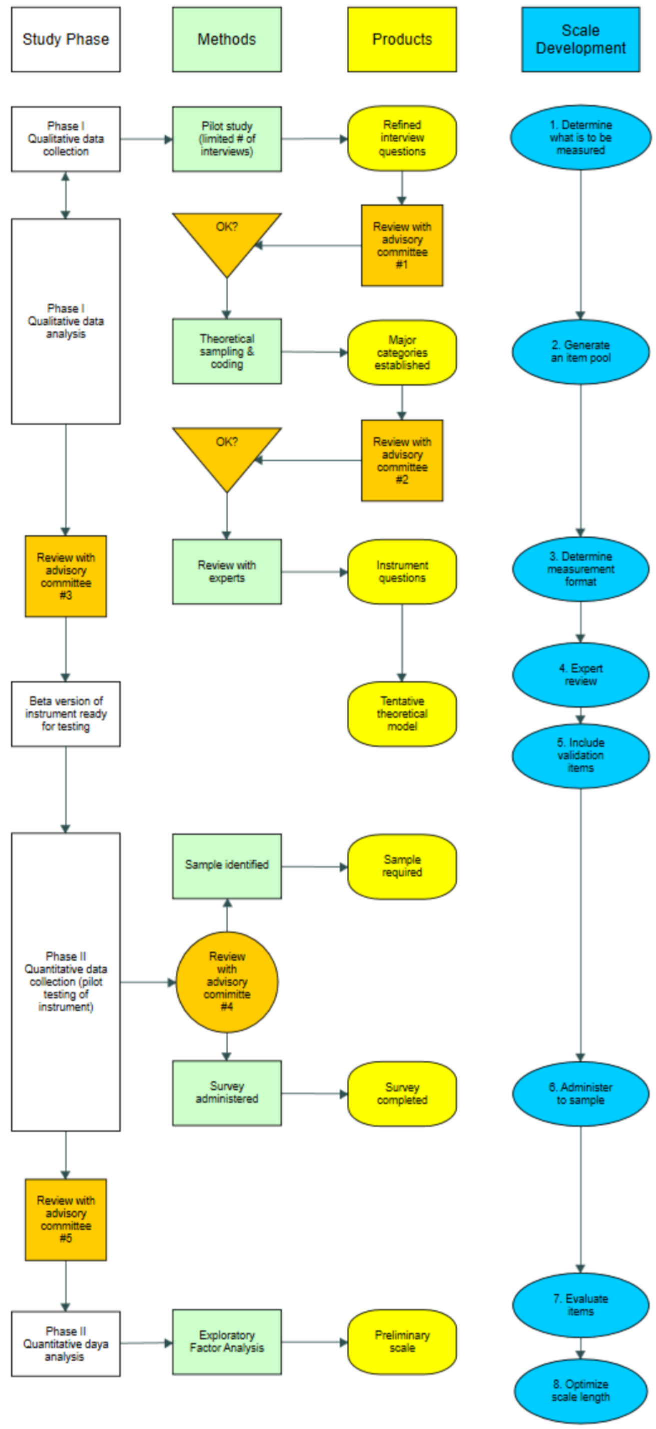

Figure 17 Initial study design as recreated in NVivo 12

For example, the *"Pilot study"* box links with a set of files collected during the pilot study, like the transcription of the initial interview, set of codes created during the analysis of the initial interview transcript, memos created while working on the first interview, and the initial items envisioned for the final instrument. Each item in this set is active and, through proper linking, supports the interrogation of data as presented in Figure 15.

Context

This researcher followed the Straussian approach to Grounded Theory, where it is necessary to link action-interaction to the conditions in which it occurs (Corbin & Strauss, 2015, p. 155). Identifying the context of action-interaction can enable researchers to build a critical commentary on product development team members' experience during the adjourning phase induced by the external event. In other words, to develop theory, we have to locate it within the context defined as the circumstances that form the setting for an event (Corbin & Strauss, 2015, p. 155).

Evoking the past in the participants of the grounded theory study is not easy and requires detailed planning and preparation, including the design of the interviews (Bryant & Charmaz, 2007; Charmaz, 2014; Clarke et al., 2016). The design of the semi-structured interviews used for this study enabled participants' descriptions of their role in the company during the significant event, followed by the participants' recount of the potential changes observed in the team members during that time and finalized with the multi-faceted reflection on these observations.

The context presentation starts with the review of the light metal forming industry dynamics and the position of the product development teams within the sample of the firms revised for this study, including the role of the ISO certifications in identifying and selecting the representative pool of participants. The context presentation continues with the significant event definitions provided by the participants and leads to the framework for locating the reported interactions.

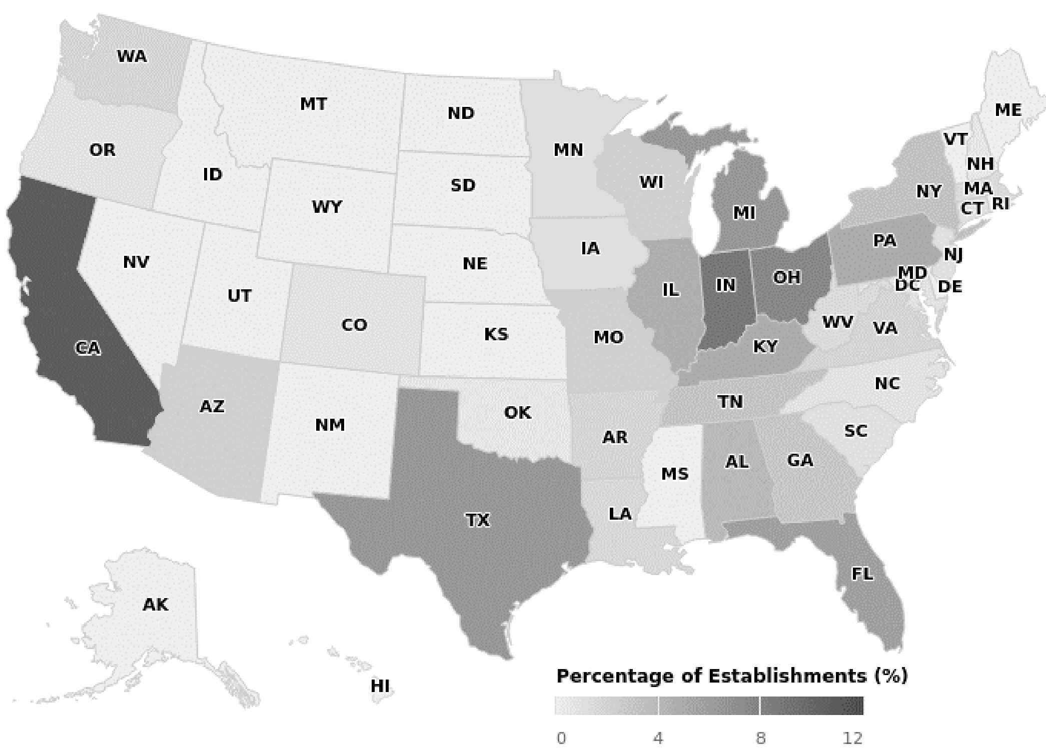

Figure 18 Aluminum manufacturing in the US

– business concentration in the US in 2021 (Egan, 2021)

The light metal forming industry

The Great Lakes region of the United States is one of the primary Aluminum processing areas, accounting for 29.7% of industry establishments. The other major producing areas are the Southeast (29.1% of establishments), the West (13.3%), and the Mid-Atlantic (10.0%). The Southwest region accounts for 9.2% of establishments, and the Plains comprise 4.7% (Egan, 2021).

The industry distribution across the country presented in Figure 18 reflects several factors. Primary Aluminum production is a very energy-intensive process, and the relatively low cost and easy access to electricity in the Southeast and West are critical factors in attracting metal forming companies to these regions. Access to key markets, such as the automotive manufacturing industry, plays an essential role in location choice (Egan, 2021).

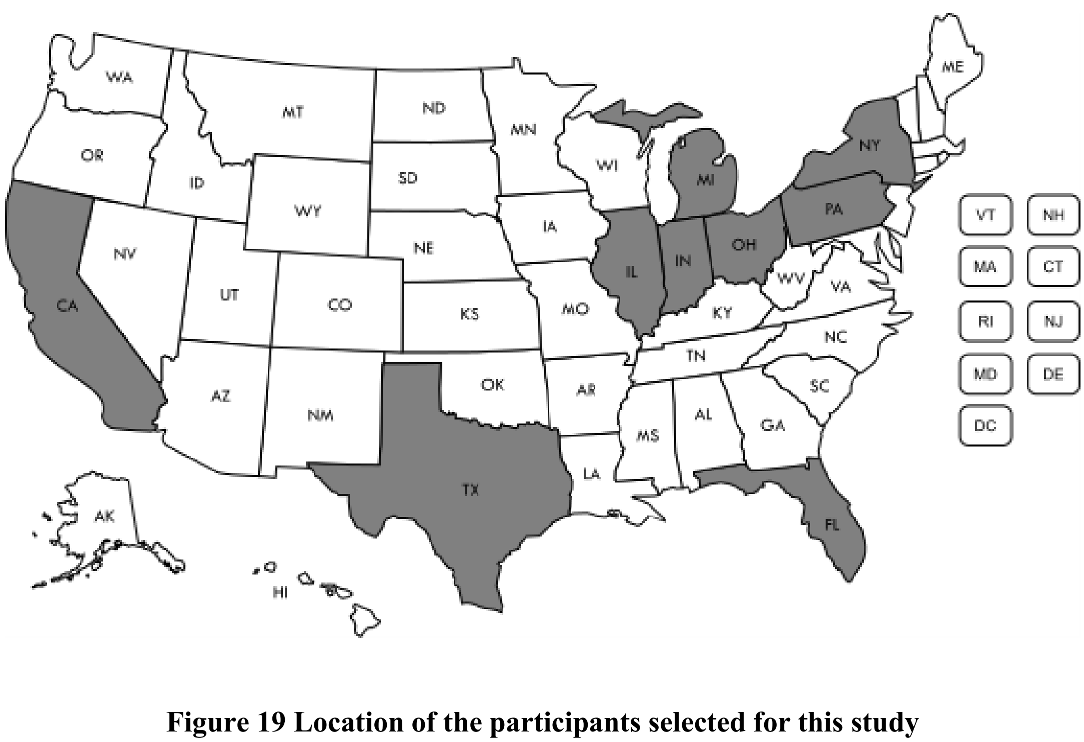

Figure 19 Location of the participants selected for this study

To accurately sample the light metal forming industry, defined as a significant part of a broader Aluminum manufacturing business in the United States, the participants from the Great Lakes region of the United States constituted over 60% of all product development practitioners in this study. Less than 30% of the participants were from the other major producing areas like the Southeast and the West. Figure 19 shows the location of participants selected for this study.

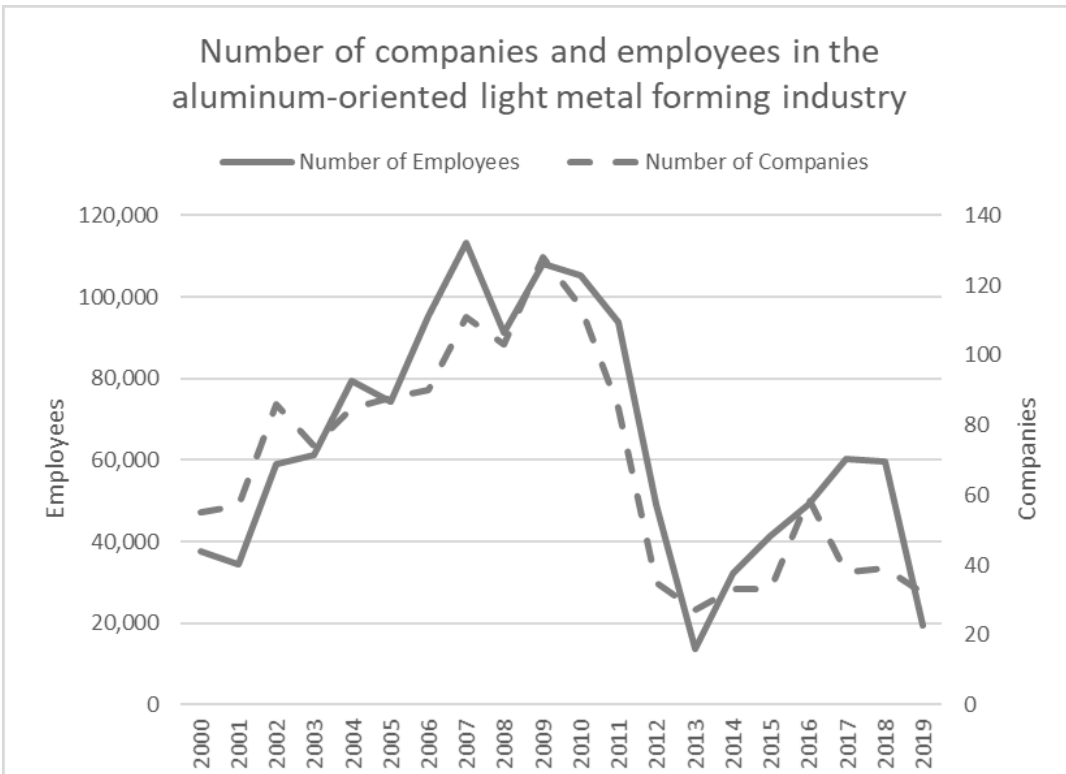

Figure 20 Number of companies and employees in the aluminum-oriented light metal forming industry in the US between 2000 and 2019

Figure 20 indicates a relatively low number of companies in the US's Aluminum-oriented light metal forming industry (*Aluminum Production, Alumina Refining and Aluminum Form Production Industry (U.S.) - Analytics, Extensive Financial Benchmarks, Metrics, and Revenue Forecasts to 2026*, 2019; G. Ross, 2021; USITC, 2017). The fragmentation of the Aluminum-oriented light metal forming industries in 2019 was below 60%, with five companies controlling above 40% of the market. Over 60% of the study's participants represented the five top companies.

In summary, the selected participants adequately represented the light metal industry selected for this investigation, including the geographical distribution of the participants across the US.

The social aspect

On March 8, 2018, President Trump exercised his authority under Section 232 of the Trade Expansion Act of 1962 to impose a 10 percent tariff on Aluminum imports, with exemptions for Canada and Mexico, to protect our national security. The President's Section 232 decision results from an investigation led by the U.S. Department of Commerce (DOC). U.S. Customs and Border Protection began collecting the tariffs on March 23, 2018 (Fefer et al., 2019). A few months later, the administration imposed tariffs on Aluminum imports from Canada and lifted them in August 2020 ("An Aluminum Tariff Reprieve," 2020). While there is little information available on the impact of Section 232 on the performance of the domestic prime Aluminum producers like Alcoa, several inquiries regarding the processes surrounding the implementation of Section 232 are in place (*Notice of Inquiry Regarding the Exclusion Process for Section 232 Steel and Aluminum Import Tariffs and Quotas*, 2020).

Regardless of the results of the inquiries regarding the processes surrounding the implementation of Section 232, the tariffs were the proverbial *"straw that broke the camel's back."* of the many companies representing the light metal forming industry in the USA (Koerner, 2018). Because of the cumulative effect of small actions and significant global events like the market crash of 2009, many small firms in the light metal forming industry have struggled with decreased demand and a saturated market (Lafferty, 2020; USITC, 2017; Yanchunas, 2020). Mergers or joint ventures with larger companies became the only way to survive for many (Henry, 2010; Schloz, 2011) – this trend has not subsided (Benedyk, 2017; Svendsen, 2017b, 2017a).

Figure 20 shows the number of employees with aluminum-oriented light metal forming companies. According to the American Community Survey completed in 2019, the average family size is 3.23 ("National Family Week: November 21-27, 2021," 2021). The significant reduction in the number of aluminum-oriented light metal forming companies in 2019 impacted employees, their families, and communities (Jacobs, 2020). In other words, it is not only over 30,000 laid-off employees but approximately 60,000 family members and countless community members that were impacted by the changes to the domestic Aluminum-oriented market. The product development team members were likely among the population impacted by the changes mentioned above making this study relevant not only from the human resources management but also organizational behavior point of view.

Not surprisingly, the product development professionals interviewed for this study mentioned the social aspect of extrinsic events impacting their companies. *(P5)* was the most vocal about it while describing the manager's role:

> *"My one job is to guide the company going forward so the company is sustainable. Moreover, I think that is number one. We have about 175 families that depend on the company for their livelihood. Furthermore, I think we owe it to the employees to be able to give them sustainable employment in a constructive and safe environment that does not adversely affect their health or mental abilities. That is probably key to my job."*

How the company's performance and its response to extrinsic events like mergers and acquisitions impact employees' family members is one of the research paths established during the analysis and coding of the interviews. Extrinsic events like mergers and acquisitions are strategies for growing a business (DePamphilis, 2011). Confidentiality is one of the critical elements of the merger and acquisition (M. L. Marks & Cutcliffe, 1988). The confidentiality requirements impact the financial side of the process and the people-related aspects (Ivancevich, Schweiger, & Power, 1987). It also impacts the amount of information shared between the management and the team members, as stated by *(P2)*:

> *"Someone who was a mentor has a phrase or term which was "you always need to be honest, the question is how open you will be". So for instance, when I have been*

in a situation where there have been, I was running a plant, …, and for several years back, and I knew we were up for sale, and people were coming through the plant, I had no ability to tell people what was going on because it was going to cost me my job. So, I was not able to be particularly open. It is very difficult, and in that situation, the fear was the motivator, maybe a fear of losing my job, my point is – different circumstances drive the degree of openness. But I do think that, from the value standpoint, if you are not honest, you lose people's trust when it is extremely hard to rebuild that trust."

As seen in the above interview fragment, the confidentiality requirements could reduce the amount of information provided to the team members. The team members are likely to notice that reduction and, without any additional evidence, could take it as a reduction in their ability to influence the company's future. The ability to influence the company's future is one of the primary product development team member's desires explicitly reported by several interviewees *(P1, P2, P4, P6, P7, and P13)*. In summary, the confidentiality induced reduction of some aspects of the communication between management and the product development team members could impact the individual team members' behavior and the overall team performance. It is beyond the scope of this study to explore the legal aspects of the confidentiality impact on team communication. However, the impact of communication level and type change during the extrinsic event is in the scope of this exploratory study and is discussed later in this study.

The dynamics of the light metal forming industry

The light metal forming industry dynamics finds their reflection in the opinions and statements provided by the study participants. Mergers and joint ventures reported in the literature (Benedyk, 2017; Henry, 2010; Schloz, 2011; Svendsen, 2017a, 2017b) are not the only types of changes experienced by the light metal forming companies. Several codes created in NVivo captured various dimensions of the type of change found in the individual interviews. Initial codes like *buyouts (P2), reductions (P2), and technological change (P1, P3, and P6)* became one aggregated code: *"Type of change."* The decrease in the number of companies and employees in the Aluminum-oriented light metal forming industry, possibly due to some buyouts and reductions, is reported elsewhere (*Aluminum Production, Alumina Refining and Aluminum Form Production Industry (U.S.) - Analytics, Extensive Financial Benchmarks, Metrics, and Revenue Forecasts to 2026*, 2019; G. Ross, 2021; USITC, 2017). The various aspects of the technological change coded in several interviews conducted for this study required additional attention outlined in the following sections.

The technological change

There are two aspects of the technological change discovered during this exploratory study of product development team members' behavior – extrinsic and intrinsic. In this report, the extrinsic technological change affects the Alumina, Aluminum, and Aluminum alloys forming industry. The extrinsic technological change covers the entire Aluminum-making process, beginning with mining, refining, casting, forming, fabrication, end-uses, and recycling, as presented in Figure 21. The extrinsic technological change requires long-term projects like reducing CO_2 emissions (*Aluminum Industry Technology Roadmap*, 2003) and increasing energy efficiency (Anich, Bagshaw, Margolis, & Skillingberg, 2017; Kenchington, Eisenhauer, & Green, 1997).

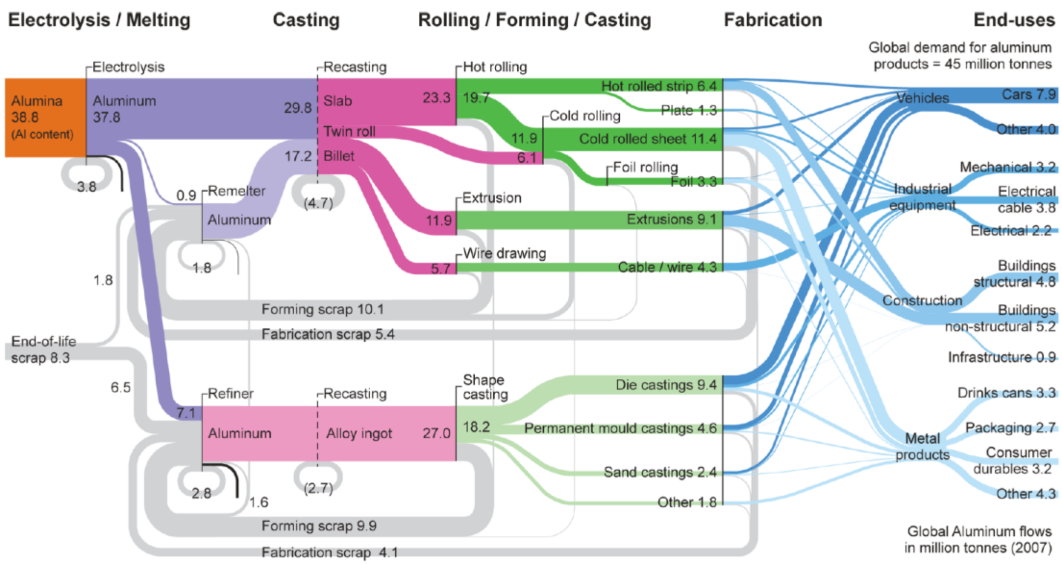

Figure 21 Global flow of aluminum from ore to end-use (Cullen & Allwood, 2013)

The effects of the implementation of the long-term projects advocated by various organizations (*Aluminum- Industry of the Future*, 2001; *Aluminum Industry Technology Roadmap*, 2003) are visible in the steady decline of the metallurgical Alumina refining energy intensity presented in Figure 22. The interviews with the product development team members confirmed the intrinsic and long-term nature of the light metal forming industry projects.

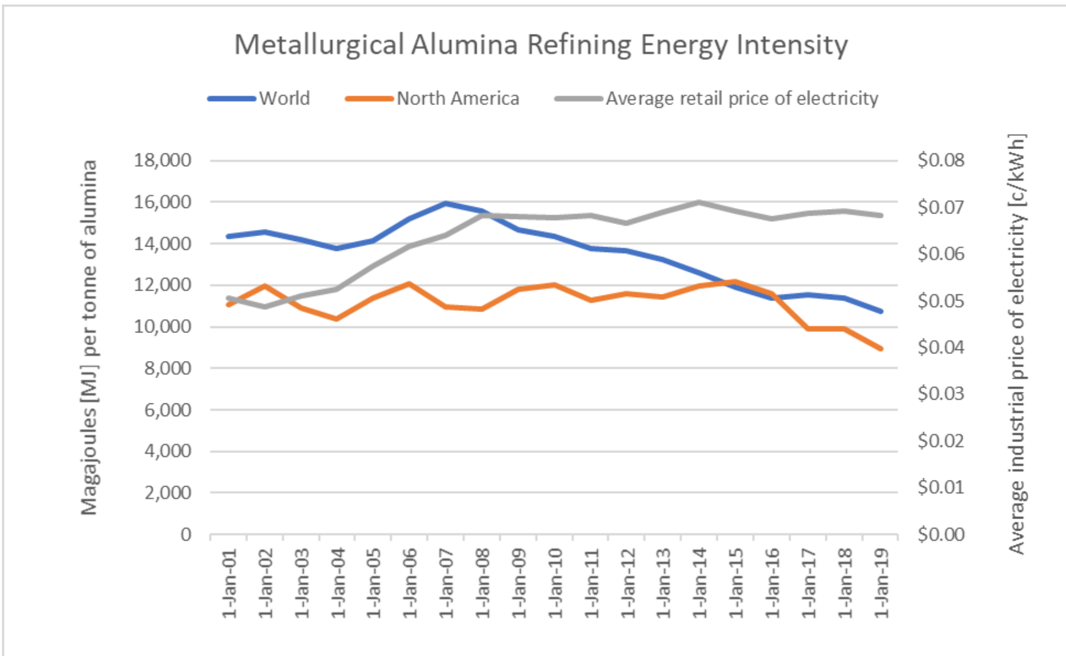

Figure 22 Change in the metallurgical alumina refining energy intensity (various sources)

(P2) commented on the project's length in terms of planning by stating that *"we are … trying to look somewhere a couple of years down the road in terms of improvement that we are making." (P2)* also added that some team members spend *"five years developing process."* It is possible to add that long-term projects may require a long-term commitment to the same company by the product development team members. *(P6)* stated that *"you*

have to stay with the same company 20 years … to have an interesting career … and have an opportunity at challenging projects … and still enjoy that," suggesting a potential role of the tenure, initially defined as a time with the product development team while studying the product development teams in the light metal forming industry.

The code capturing tenure-related information from the interviews collected for this study was not one of the initial codes created while coding the information. One of the initial codes capturing the time aspect of the team processes was *"experience" (P1, P2, P3, and P4)*. After coding the first interview, the code *"experience"* expanded into *"experience defined as participation in"* and *"experience defined as acquaintance with."*

The *"participation in"* code, expanding the initial *"experience"* code, captured participants' statements about the nature of the significant events they experienced or witnessed. Some of the significant events described by the participants include: *"another customer leaving because of their shutdown" (P1)*, *"almost going bankrupt" (P1), "they … pretty much gassed all the management" (P2),* or *"we did not sell any … in over a year" (P3)*. The description of the significance of the events depends on the person describing them; however, all the descriptions mentioned above share the same characteristic – the extrinsic nature of the change and its potential impact on the entire organization, including the product development teams. The nature of the product development team found within the metal forming companies required additional information collected during the interviews.

The presence of the product development team

In 1946 members of the International Federation of the National Standardizing Associations and the United Nations Standards Coordinating Committee established a new global international standardizing body named the International Organization for Standardization or ISO (Eicher et al., 1997). In 1987, the European Union established ISO 9000 certification. Some of the goals were to (1) protect customers, (2) reduce the multitude of not consistent terminology or content, and (3) facilitate international trade. Eight quality management principles included in the ISO 9000 series of standards are (1) customer focus, (2) leadership, (3) involvement of people, (4) process approach, (5) system approach to management, (6) continual improvement, (7) factual approach to decision making, and (8) mutually beneficial supplier relationships (Dahlgaard-park, 2015). Contrary to a common misperception, ISO 9000 does not include any references to product performance.

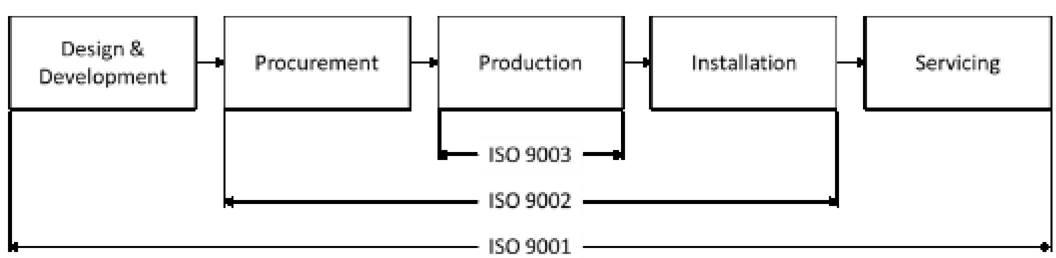

Figure 23 ISO 9000 Standards, their Areas in Production Flow

Although this certification is a voluntary quality management practice, it is necessary to do business with many members of the EU. Moreover, in the EU, ISO 9000 certification is a legal requirement in medical devices, high-pressure valves, and public transportation (Wu & Wu, 2019). On the other hand, nothing stops a company from following ISO 9000 specifications without seeking certification. Many industrial buyers prefer ISO 9000 certified suppliers, and certification is no longer an option. It is one of the controversies surrounding the ISO 9000 certification, as some see it as a hidden trade barrier (Leseure et al., 2014).

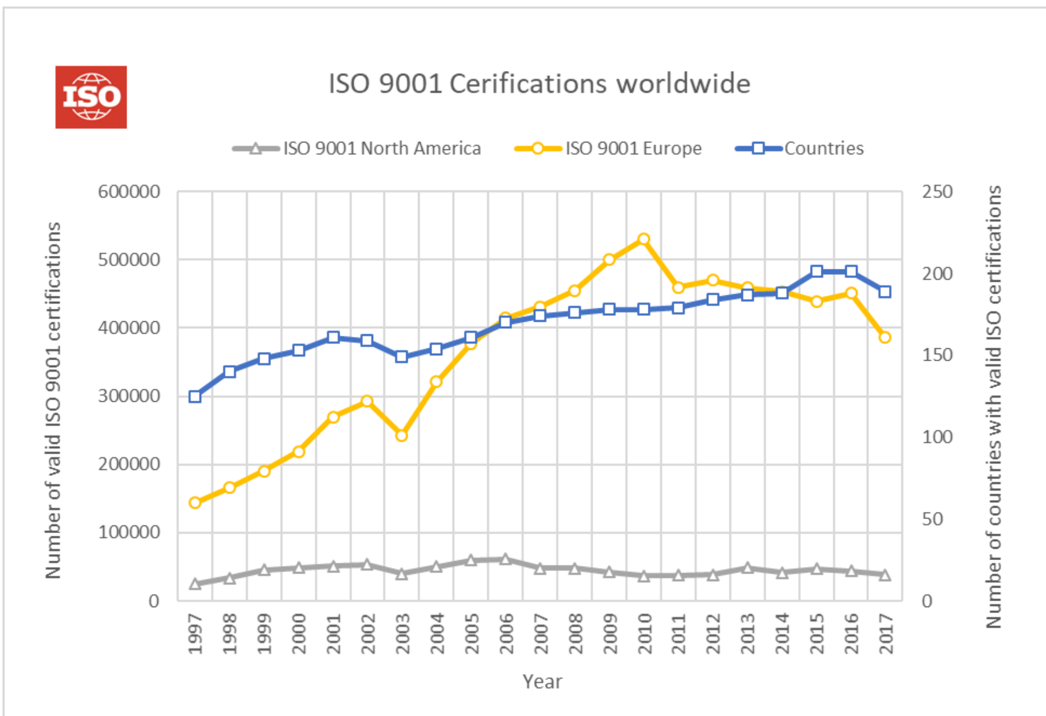

Figure 24 The development in the number of ISO9001 certifications in Europe and North America

ISO 9000 certification audit evaluates the management of the entire manufacturing process. Figure 23 shows the areas of the ISO 900x standards within the production flow and guidelines for use. Any firm seeking ISO 9001 certification must identify the organizational personnel responsible for conducting, performing, and accomplishing design and development tasks (Abuhav, 2017, p. 232).

International Organization for Standards conducts an annual ISO Survey of Certifications ("The ISO Survey of Management System Standard Certifications - 2018 - Explanatory Note," 2019). Figure 24 shows the number of ISO 9001 certifications in Europe and North America. The data presented in Figure 24 includes the number of countries in which some firms are qualified for the various ISO certifications ("ISO 9001 - data per country and sector," 2018). Between 1997 to 2002, the number of countries where new companies are ISO certified steadily increased. During the same period, the number of firms with ISO 9001 certifications in the EU and the US also increased. Between 2004 and 2010, the number of ISO 9001 certifications in the EU almost doubled; in 2004, ten countries from Central and Eastern Europe joined the EU, followed by two more in 2007. The EU enlargement opened new markets for existing and new members of the EU. As mentioned before, ISO certification is necessary for doing business with any member of the EU (Aswathappa, 2015, p.492). That may explain the sudden jump in the number of ISO certifications issued between 2004 and 2010. In the same period, the number of ISO certifications issued in the US remained steady. Not all EU members immediately opened markets to the new EU members in 2004, and gaining ISO 9001 certification played a critical role in opening the remaining EU markets following the EU enlargement (Georgiev & Georgiev, 2015).

Wu and Wu (2019) studied the impact of ISO certifications and new product success in an emerging market. The researchers concluded that a firm with sought-after certifications assures its potential customers (Wu & Wu, 2019) and reduces the information asymmetry between the firm and the customer. Additionally, the voluntary ISO9001 certification requires transparency, boosting the firm's legitimacy in emerging markets where it is costly for buyers to access technical information about new products. Boiral (2012) completed a systematic review of ISO 9000 and organizational effectiveness. The author identified only seven studies on the operational impact of ISO 9001 on innovation and design. The identified studies showed that the systematic application of procedures required by ISO 9000 certification positively impacted technological innovation and product design (Boiral, 2012).

There are many more benefits of the ISO 9001 standards than already presented (Tarí, Molina-Azorín, & Heras, 2012). The improved business performance, potentially leading to a market share increase, is one of the most significant benefits. Implementation of the ISO 9001 standard has a positive impact on continuous improvement. ISO 9001 standard suggests that firms understand and satisfy present and potential customers' current and future expectations (Rusjan & Alič, 2010).

During the interviews, only one participant *(P1)* could not confirm the presence of the formal product development team while confirming the company's ISO certification in the following statement:

> *"Oh, I do not think we have a formal name for it. But what will happen is when we have an opportunity, we will form a small group generally structured around some*

> *of our ISO procedures in terms of improvement projects … The composition changes based on the opportunity and the people that would be involved in it at some point., I mean, there will be some people that are always involved … And then we will bring in people from different areas … based on the issue … We do not give it a name, it is just it."*

All remaining participants confirmed ISO certification of their companies and the presence of one *(P3, P5, P7, and P8)* or more product development teams *(P2, P6, P10, P11, and P12)*, *"supporting element or subset of process and product improvement"* (P2), *"supporting customers approaching … and asking … to make the product … more efficient, safer, or with higher quality."*

Context – Summary

As indicated at the beginning of this section, identifying the context of action-interaction can enable researchers to build a critical commentary on product development team members' experience during the adjourning phase induced by the external event. In other words, to develop a theory, the researcher must be sensitive to the setting and situation of research (Bryant & Charmaz, 2007, p. 251) and locate it within the context defined as the circumstances that form the setting for an event (Corbin & Strauss, 2015, p. 155).

Specifically, the light metal industry is well established in the USA (Egan, 2021), with some of the professionals in the product development teams working on long-term projects (Anich et al., 2017), and identified as critical for the future of this industry domestically

(*Aluminum Industry Technology Roadmap*, 2003) and worldwide (*Aluminum- Industry of the Future*, 2001). Mergers or joint ventures with larger companies became one of the ways to survive for many light metal forming companies (Henry, 2010; Schloz, 2011) – this trend has not subsided in the past 40 years (Benedyk, 2017; Svendsen, 2017b, 2017a). ISO 9001 certification recently became one of several indicators of the presence of the product development team within a company (Tarí et al., 2012). The coded interview results confirmed the feasibility of the light metal forming industry as a platform to study the potential impact of the extrinsic events on the development and performance of the product development team members. The emergence of several time-dependent concepts further strengthened the initial expectations about the light metal forming industry dynamics.

This study includes only basic demographic information about interviewed product development professionals. Detailed information about the participants, like their age or position in the organization, would lead to their identification (Urquhart, 2013, p. 153). The context protocol created after each interview (Flick, 2018, p. 97; Ortega, García, & Santos, 2017) included initial impressions and an expanded description of the interviewee's most striking or unexpected statements without revealing the participant's position while they were experiencing situations described in the interviews.

Finally, the author of this study followed Urquhart's advice (2013, p. 153) to balance the description of the context for the analysis and avoid un-anchoring it by providing too much description leading to "a nice story." Such an approach of a balanced description of the individuals and firm's connection to the macro content follows Charmaz's (2014, p. 243) recommendation on grounding the theory and, through inductive theorizing, opening the possibility of novel understanding, increasing the researcher's knowledge.

In summary, the discussion of the context presented in this section indicates the Straussian nature of this research demonstrates that this exploratory research design is not a situational analysis in which *"there is no such thing as context"* (Clarke et al., 2016, p. 98).

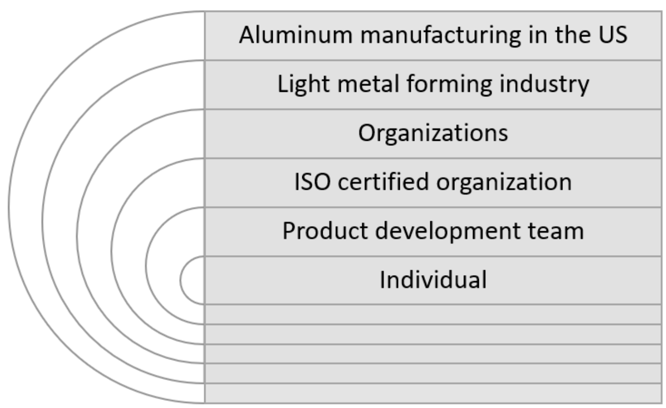

Figure 25 Conditional matrix

Moreover, this researcher created the conditional matrix following examples established by Straus and Corbin (1990. 1998) and Corbin and Strauss (2015). The matrix presented in Figure 25 provided systematic paths for this grounded theory student to follow in order to facilitate specifying the silent structural conditions obtained from the exploratory study of the behavior of the product development team members under extrinsic conditions impacting the light metal forming company representing the Aluminum manufacturing industry in the USA. The concentric circles in Figure 25 represent the structural conditions or a *context*, arrayed *around* the central focus from local to global. The conditional matrix in Figure 25 is only a conceptual guide adopted to support this study and does not imply that the product development team members' responses are linear.

Such an adaptation of the conditional matrix to individual studies is present in some grounded theory literature (Clarke et al., 2016; Dey, 1993; Partington, 2000; Taylor, Bogdan, & DeVault, 2016; Wilson Scott & Howell, 2008; Yin, 2011). The opposite situation, where actors construct their situation and how the social organizations emerge, is a subject of the interactionist analysis (Hall, 1997; Mead, 1932; Visser, 2019; Zhao, 2015) and is not covered in this study.

Lastly, Hall’s (1997, p. 401) fierce critique of the *“imagery of the conditional matrix as a set of concentric circles”* as a heuristic device serves as the final argument for using the conditional matrix in this exploratory or heuristic study of the behavior of the product development team members under extrinsic conditions.

Summary

The selection of an adequate research method is critical to completing the research. This researcher selected the sequential mixed methods for the exploratory study of the behavior changes among the team members. Before selecting this method, the researcher considered the convergent design to compare the views of the product development team managers and, separately, the product development team members. This approach would compromise the quantitative method selection with the phenomenological method as the primary choice. Additionally, the standard convergent design does not support instrument design and testing, leaving the researcher with the advanced convergent design. In the advanced convergent design, one strand focuses on the qualitative data while the other deals with the quantitative data before both strands merge during the analysis stage (Creswell & Plano Clark, 2018). It is an exciting research perspective if the qualitative instruments are available.

The phenomenological study brings up the common meaning behind a phenomenon or concept reported by individuals who lived or experienced it (Creswell & Poth, 2018). In the phenomenological study, researchers identify a phenomenon and then collect data from persons who experienced the phenomenon before developing a composite description. The researcher asks similar questions to the selected group of people and finds the common themes. The common themes could serve as a pool of items for the scale to assess the phenomenon. Again, while the phenomenological study is exciting, the researcher must define the concept. Unfortunately, the adjourning stage concept in Tuckman's team development model is not well understood or described in the literature, rendering the phenomenological approach not applicable (Braaten, 1974; Keyton, 1993; Tuckman & Jensen, 1977; Wheelan & Hochberger, 1996).

The selected mixed methods sequential design allowed for a proper understanding and initial description of the adjourning phenomenon before proposing an instrument to assess the team members before and after the adjourning-like significant event. The detailed research flow chart supported the sequential design and allowed for easy navigation between the design elements. The flow chart also increased the clarity of communication between the researcher and other scholars involved in this study. Finally, the sequential design results follow the design sequence presented in the next chapter.

Chapter 4
Results

Overview

"Change begets change"[2] is the most succinct way to summarize the findings presented in this chapter. In other words, a new level of the team development process seldom stabilizes at the same level as observed before the adjourning-like change to the team's environment.

Organization of the Remainder of this Chapter

Chapter 4 begins with the results of coding of the interviews with the product development professionals representing the light metal forming industry in the USA. The subsequent discussion of the paradigm leads to the presentation of scales selected for this exploratory study. The results of the Exploratory Factor Analysis of the Teams Interactions Scale developed during this study are presented last.

One of the essential results presented in this chapter is the substantive theory of Monitoring Team Interactions accompanied by the tentative theoretical diagram. The survey results from 41 participants representing the light metal forming industry enabled the correlations analysis. The joint display of qualitative and quantitative results concludes the presentation of results in Chapter 4.

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[2] *Martin Chuzzlewit* by Charles Dickens (1844)

Research Questions

The following research questions guide this study:

1. What team member behavioral characteristics, derived from the interviews with product development professionals representing the light metal forming industry, change during Tuckman's adjourning phase?
2. If the derived characteristic behavior's change is present, how to determine the level of change?

Interviews

Several researchers indicated that the pilot study (Puerta, 2008) and a limited number of initial open-ended questions (Burns, 1989; Clarke D.J., 2007; Manuel, 2016; Puerta, 2008) provide richer data and faster emergence of themes during the data analysis. Appendix C contains an example of an interview protocol envisioned for the initial 2 to 4 interviews. The questions were created by following guidelines proposed by Charmaz (2014) and served as a foundation for the pilot test. The iterative process of grounded theory allows for new inquiry lines in later interviews that reflect the developing analyses (Charmaz, 2014, p. 103). Indeed, this researcher adjusted the interview protocol after the first interview and used the adjusted version during the remaining interviews presented in Appendix D.

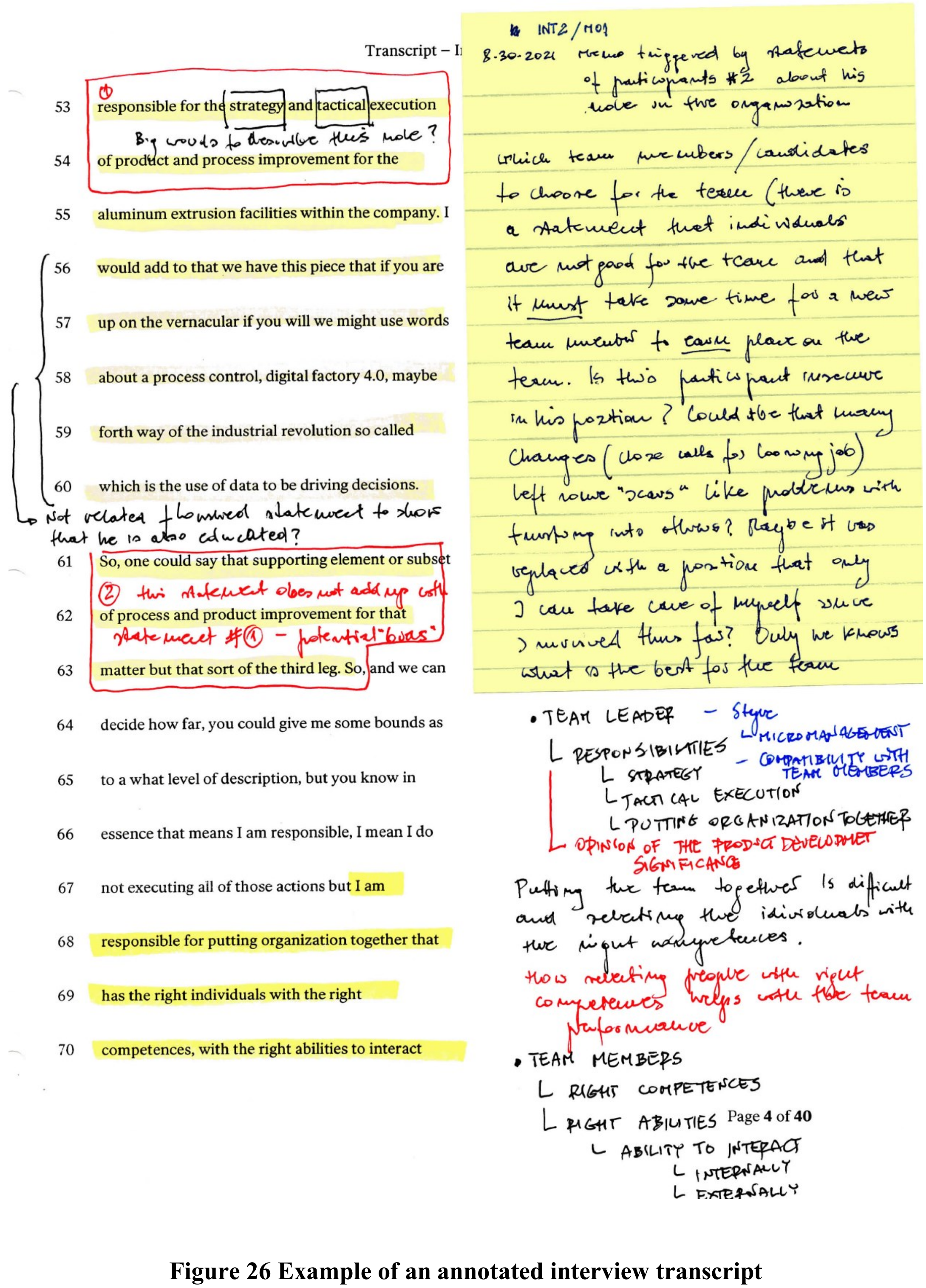
Of over 20 product development professionals approached for this study, 16 agreed to the interview during the qualitative phase. Due to the COVID-19 travel and visiting restrictions, all interviews were remotely using the Microsoft Teams application. Each interview had three phases: (1) the initial and general remarks, (2) the primary interview, and (3) the Q&A session on the topics discussed during the interview. The interview recording, including an audio stream exclusively, started after the initial remarks session.

The opening of the interview is critical because it sets the tone and climate of the interview. It signals whether the interview will be formal or informal, relaxed or tense, professional or nonprofessional, friendly or hostile, nonthreatening, or threatening (Stewart, 2009). This researcher started the primary interview with the best single question for semi-structured interviews, also known as a ground tour question (Spradley, 1979). As the name suggests, these questions ask respondents to give a verbal tour of something they know well (Leech, 2002). In this case, the ground tour questions invited the product development professionals to talk about themselves and the product or process development teams they lead or sued to lead.

As stated earlier in this report, to maximize the value of any research project, this researcher followed the principles of problem-solving techniques like Six Sigma DMAIC (Define, Measure, Analyze, Implement, and Control) (Mikel & Schroeder, 2000) and Total Quality PDCA (Plan, Do, Check, Act) (Imai, 1986). Specifically, this researcher used the DMAIC way of the root cause analysis and applied the “drill down” approach to encourage the interviewees during the central part of the interview to provide more details on the specific aspects while describing the potential changes observed in the team members' behavior during extrinsically induced events. Qu and Dumay (2011) stated that *“interviews provide a useful way for researchers to learn about the world of others, although real understanding may sometimes be elusive.”* The drill-down approach was a way to reduce elusiveness and make the answers more tangible, thus easier to define and potentially measure. Using the drill-down approach, the communication between interviewer and interviewee becomes less complicated even when these people do not share the worldview (Qu & Dumay, 2011).

The final part of each interview was more personal than the previous parts. The participants had a better understanding of the nature of this exploratory research into the product development team and the team members' behavior during times of change. The participants offered additional insight into their perspective on the team behavior and how they are trying to lead the teams while keeping an eye on the individual team members' behavior. The information gathered during the final part of the interview provided the widest variety of information on the product development teams representing the light metal forming industry in the USA.

This researcher manually transcribed the interview audio files to preserve the morphologic naturalness of transcription (McLellan et al., 2003). Such a transcription style is known as denaturalized transcription (Bucholtz, 2000) and is present in studies involving grounded theory and critical disclosures analysis (Davidson, 2009; Oliver, D; Serovich, J; Mason, 2005). Moreover, manual transcription furthers the interviewee's identity protection (J. Da Silva, 2021) and offers a unique opportunity to deep dive into the data. As presented in Figure 26, each transcript page had individually numbered text lines for ease of referencing and the text running on the left side of the page, leaving the right side of each page empty for notes and annotations.



Transcript – I

① responsible for the strategy and tactical execution

Big words to describe his role?

of product and process improvement for the aluminum extrusion facilities within the company. I would add to that we have this piece that if you are up on the vernacular if you will we might use words about a process control, digital factory 4.0, maybe forth way of the industrial revolution so called which is the use of data to be driving decisions.

Not related / borrowed statement to show that he is also educated?

So, one could say that supporting element or subset

② this statement does not add up with

of process and product improvement for that

statement #① – potential "bias"

matter but that sort of the third leg. So, and we can decide how far, you could give me some bounds as to a what level of description, but you know in essence that means I am responsible, I mean I do not executing all of those actions but I am responsible for putting organization together that has the right individuals with the right competences, with the right abilities to interact

INT2 / M01

8-30-2021 memo triggered by statements of participants #2 about his role in the organization

which team members / candidates to choose for the team (there is a statement that individuals are not good for the team and that it must take some time for a new team member to earn place on the team. Is this participant insecure in his position? Could it be that many changes (close calls for loosing job) left some "scars" like problems with trusting into others? Maybe it was replaced with a position that only I can take care of myself since I survived thus far? Only he knows what is the best for the team

- TEAM LEADER – Style
  - L MICROMANAGEMENT
  - – COMPATIBILITY WITH TEAM MEMBERS
  - L RESPONSIBILITIES
    - L STRATEGY
    - L TACTICAL EXECUTION
    - L PUTTING ORGANIZATION TOGETHER
  - L OPINION OF THE PRODUCT DEVELOPMENT SIGNIFICANCE

Putting the team together is difficult and selecting the individuals with the right competences.

How selecting people with right competences helps with the team performance

- TEAM MEMBERS
  - L RIGHT COMPETENCES
  - L RIGHT ABILITIES
    - L ABILITY TO INTERACT
      - L INTERNALLY
      - L EXTERNALLY

Page 4 of 40

Figure 26 Example of an annotated interview transcript

The semi-structured interviews allow the researcher to build a list of themes and opinions held by the population (Glaser & Strauss, 1967). In this exploratory study, the interviewees represent the population of the product development professionals found in the light metal forming industry in the USA. As explained in Chapter 3, this researcher followed Strauss's (1987) advice and used the tools available in NVivo 12 to track the number of new codes and coding to the existing codes as a proxy to the coding saturation. The following section describes the coding results and provides information on some interviews used in this study.

Coding

Coding is the grounded theory's core process of analyzing data (Bryant & Charmaz, 2007; Walker & Myrick, 2006). *"A code is an abstract representation of an object or phenomenon"* (Corbin & Strauss, 2015, p. 66), and it *"is most often a word or a short phrase that symbolically assigns a summative, salient, essence-capturing and evocative attribute for a portion of language-based or visual data"* (Saldana, 2016 p. 4). Strauss (1989) called codes *"relevant portions of data to help address the research problem."*

This researcher transcribed the audio files and saved the transcriptions in the Microsoft Word file format. The first coding round was manual, using the printout of the interview's transcription. As presented in Figure 26, not all highlighted text was equal, while some highlighted text inspired annotations, separate notes, and follow-up notes. The annotated copy of the interview's transcript was scanned and imported into NVivo 12 software for further processing. The second coding round generated codes available for use while processing the consecutive interviews.

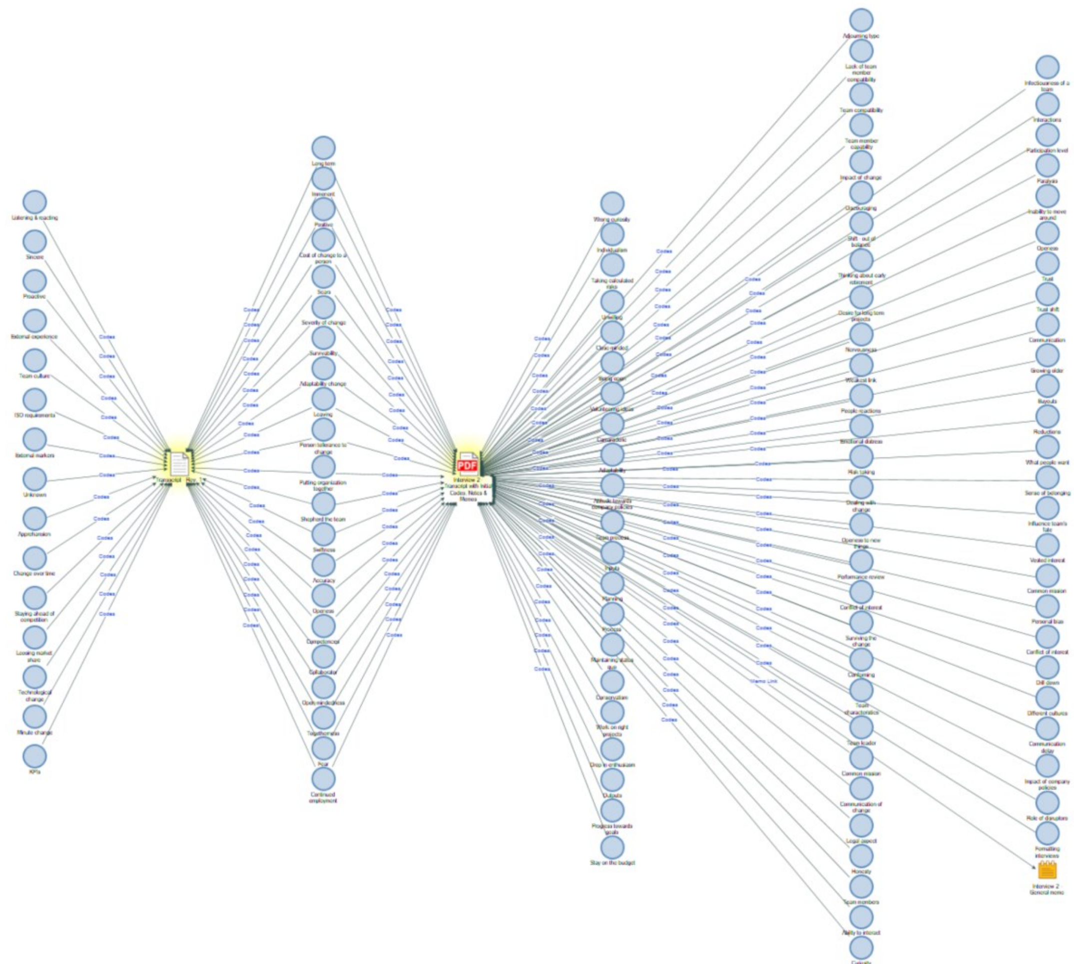


Figure 27 Comparison diagram generated in NVivo comparing the number of codes for two different interviews

This researcher created a basic codes structure before processing the first interview. The basic code's structure included the following codes (1) *Future research*, (2) *Measures*, (3) *Methodological issues*, (4) *Good quotes*, and (5) *Retired codes*. Some of the core category codes like *"What people want"* and *"Team process"* emerged during the analysis of the first interview. NVivo 12 can visualize the difference in codes distribution between two documents. Figure 27 shows a comparison diagram generated in NVivo and compares the codes generated during the first and second interview analyses. It is possible to observe that the number of codes generated during the analysis of the first interview is much lower than the number of codes generated for the second interview. It is also possible to observe that some nodes (marked with lines connecting icons representing interviews one and two) are common for both interviews.

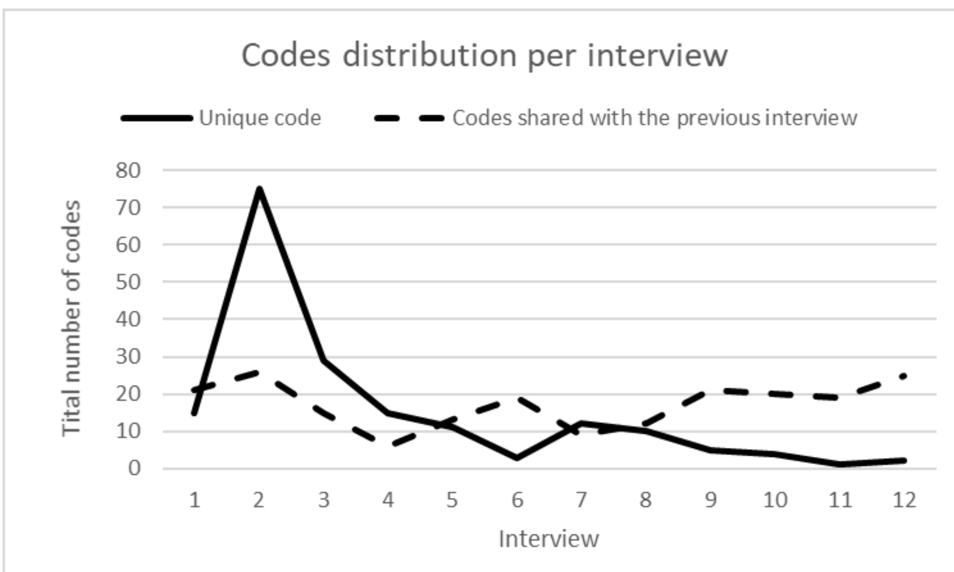


Figure 28 Codes distribution per consecutive interview

Figure 28 shows codes distribution per consecutive interview completed for this exploratory study. The solid line indicates the change in the number of codes used to code an individual interview. The dashed line shows codes shared between two consecutive interviews. The codes distribution presented in Figure 28 indicates a high number of unique codes generated during the analysis of the initial five interviews, while the number of shared codes started to plateau. Figure 28 also indicates a similar number of shared codes used during the analysis of interviews seven through sixteen, with a steady decrease of unique codes generated during the analysis of interviews seven through sixteen.

The number of interviews yielding the initial open coding structure is similar to the number of interviews reported in the literature (Guest et al., 2006; Hennink et al., 2017). This researcher followed Strauss's (1987) recommendation and used open coding to *"analyze the data minutely"* (p. 31). This effort was necessary to achieve an extensive theoretical coverage thoroughly grounded in data. Additionally, this effort minimized the overlooking of important categories and enabled a conceptually dense category. After achieving the open coding saturation, this researcher purposely invited additional product development professionals and interviewed them while probing for one category at a time in terms of the paradigm items (conditions, actions-interactions, and consequences). This type of coding is called *axial coding* and is the subject of the next section.

The Paradigm

In the Straussian approach to the grounded theory used in this study, the paradigm is *"an analytic tool to help analysts carry out axial coding or coding around the category"* (Corbin & Strauss, 2015, p. 156). In other words, the paradigm is a tool "*to sort out and arrange concepts by asking questions and thinking in terms of possible linkages"* (Corbin & Strauss, 2015, p. 156).

The Straussian definition of paradigm is different from the definition used by many qualitative research scholars (Adu, 2019; Bryant & Charmaz, 2007; Bryman & Bell, 2007; Buchanan & Bryman, 2009; Creswell, 2009; Creswell & Plano Clark, 2018; Creswell & Poth, 2018; Denzin & Lincoln, 2005; Kuhn, 2010; Maxwell, 2013; D. L. Morgan, 2007; Walsh et al., 2015). Some of the other paradigm definitions are *"a worldview"* (Creswell, 2009), *"a basic set of beliefs that guide the action"* (Walsh et al., 2015), or *"a philosophical way of thinking"* (Kuhn, 2010).

Although the Straussian definition of paradigm and the qualitative research definition of paradigm are not identical, they share the specific terminology the scientists use concerning theory, such as (a) conditions, (b) actions-interactions, and (c) consequences. In other words, the common element of both paradigms' definitions is that the paradigm is a lens through which the scholar sees the world and interprets that world. Additionally, unlike some standard qualitative research approaches (Creswell, 2009; Creswell & Plano Clark, 2018; Maxwell, 2013), the Straussian definition of paradigm does not stipulate that the researcher must select a worldview and precisely indicate it before conducting the research. Even Strauss did not fully articulate his worldview until the publication of his last book, *Continual Permutations of Action* (Strauss, 1993), which occurred shortly before his death (Corbin & Strauss, 2015, p. 21).

Conversely, the Straussian version of the grounded theory shares the assumptions of pragmatism and interactionism philosophies and leads to the following description of the nature of the potential theory resulting from this research:

> *"It would have to be a theory that captures the complexity and ambiguity inherent in events and behavior; that shows change as well as permanence in situations; that explains that while action and interaction may be routine today, they might just as well be problematic tomorrow; and a theory that while answering questions leaves open the possibility today's answers may ultimately become the questions of tomorrow"* (Corbin & Strauss, 2015, p. 22).

This researcher was not committed to any one system of philosophy and reality, values freedom of choice, and was interested in applying the research results. According to Cherryholmes (1992) and Mitchell (2018), no commitment to one system of philosophy, freedom of choice, and looking to the "what" and "how" are characteristics of pragmatism. For this study, this researcher adopted some of the elements of the pragmatism philosophy, further strengthening the decision to select the Straussian version of the grounded theory for completing this exploratory study of the impact of extrinsic conditions on the behavior of the product development team members in the light metal forming industry.

Conditions

In the Straussian approach to grounded theory methodology, conditions answer to the questions about why, when, and how come (Corbin & Strauss, 2015, p. 158). According to Corbin and Strauss (2015), *"they refer to the perceived reasons that persons give for why things happen and the explanations that they give for why they respond in the manner that they do through action-interaction."* In this study, the conditions come from the product development professionals describing the behavior of product development team members during and after significant extrinsic events observed in the light metal forming industry in the US. In other words, the definition of conditions used in this study is "*the perceived reasons that persons give for why things happen (since they witnessed these things at the same time as the other team members) and the explanations that they give for why the other team members responded in the manner that they did through action-interaction."* Such an adjustment to the definition of conditions is in line with this study's exploratory nature. This study described the change in the individual team member's behavior during and after the significant event and established definitions for measuring these changes using interviews with the team managers.

As described in the previous sections, the light metal industry is well established in the US (Egan, 2021), with some of the professionals on the product development teams potentially working on long-term projects (Anich et al., 2017) identified as critical for the future of this industry domestically (*Aluminum Industry Technology Roadmap*, 2003) and worldwide (*Aluminum- Industry of the Future*, 2001). Mergers or joint ventures with larger companies became the only way to survive for many (Henry, 2010; Schloz, 2011) – this trend has not subsided in the past 40 years (Benedyk, 2017; Svendsen, 2017b, 2017a).

The study participants were positive when the light metal industry companies faced significant events. Some of the critical events described by the participants included: *"another customer leaving because of their shutdown" (P1)*, *"almost going bankrupt" (P1)*, *"they … pretty much gassed all the management" (P2)*, or *"we did not sell any … in over a year" (P3)*. Not all extrinsic events reported by the participants were adverse. *(P5)* indicated that *"we've picked up significant market share in the last year,"* and *(P6)* stated that *"after several years of development … we are introducing new technology that will secure our market share."*

The organizations in which people work have a significant impact on their thoughts, feelings, and actions in the workplace. Similarly, people's thoughts, feelings, and actions affect the organization in which they work (Brief & Weiss, 2002; Schneider, 1987). Conversely, the description of the significance of the events depends on the person describing them; however, all the interviews mentioned above share the same characteristic – the extrinsic nature of the change and its potential impact on the entire organization, including the product development teams.

One of the deeply embedded ways of thinking about organizations is the open system perspective of organizations (J. D. Thompson, 1967). Figure 3 depicts an organization embedded within an external environment (McShane & Glinow, 2009, p. 6). Such an open system has a permeable relationship with the external environment. The subsystems like product development teams in the light metal forming industry transform inputs into outputs. One of the potential outputs is a change in employee behavior. Therefore it stands to reason that the shift in the external environment, like a merger of two companies within the light metal industry or significant technological change, will impact some of the subsystems, like product development teams, in their respective organizations.

Steady State - Performing

As indicated in the study by Offermann and Spiros (2001), Tuckman's model is the most highly accepted model of the dynamic process by which teams are formed and become functional. The model has been part of the curriculum in practitioner seminars and university classrooms for more than four decades (Betts & Healy, 2015).

In 1965, Tuckman published a meta-analysis of 50 papers, including psychoanalytic studies of therapy groups. Tuckman (1965) focused on interpersonal relationships, and task activities deduced from the published reports and articles, hypothesized a four-stage model, and coined the following names for each stage (1) *forming*, (2) *storming*, (3) *norming*, and (4) *performing*.

During the first stage of team development, called *forming*, the group becomes oriented to the task and could create ground rules and establish relationships within the team and the organization. The second stage, *storming*, represents a time of intergroup conflict characterized by a lack of unity and polarization around interpersonal issues. Tuckman (1965, p. 386) stated that *"group members become hostile toward one another and a therapist or trainer, as a means of expressing their individuality and resisting the* *formation of group structure."* Throughout the third stage, *norming*, the group develops cohesion by accepting each other idiosyncrasies and developing the most effective ways to work with each other. The final stage of the original model, *performing*, begins when the group members start to channel their energy into the task. The roles within a group are clear and accepted by the group members.

The knowledge of the behavioral characteristics of product development team members during the steady-state or performing stage in the team development is a necessary baseline for evaluation of the potential behavioral changes among the product development team members representing the light metal industry resulting from the extrinsic events like company mergers, acquisitions, joint ventures or technological changes. As described in Chapter 3, this researcher interviewed product development professionals and asked them, among other things, about the desired product development team members' characteristics to establish the above-described baseline.

All interviewed product development professionals were either actively recruiting for the product development teams or recruited for product development teams before. C*ommunication skills, cooperation skills*, and *fit with the group or organization* were among the skills desired by the team leaders for the new product development team members. The follow-up questions about the communication skills added the following dimensions, including *listening and reacting (P3), meeting dynamics (P7),* and meeting *frequency (P2)*. Other participants voiced a similar opinion about communication skills and were clear that one can learn how to listen or present the results while, at the same time, it is challenging for a team member to develop these skills quickly.

Effective communication is a cornerstone of effective teams performance (Al-Ani & Edwards, 2008; Bhatti & Ahsan, 2017; Katz, 1982; Khalid, Farooq, & Mahmood, 2021; Lumsden, Lumsden, & Wiethoff, 2010; Sigman, 1991; Yost & Tucker, 2000). The amount of communication among the team members (Patrashkova & McComb, 2004) and the time to develop communication skills (Al-Ani & Edwards, 2008) are just a few examples of the recent development in the area of team communication. Patrashkova and McComb (2004) studied communication and performance in cross-functional new product development teams and demonstrated that infrequent communication and information overload could negatively impact team performance. Patrashkova and McComb's (2004) results somewhat match the opinions of the product development professionals interviewed for this study, where the accuracy of information and swiftness of delivery are much more important than the frequency of communication among the team members.

Similar congruence between data found in the interviews and reported in the literature is observed regarding the time to develop communication patterns within a team. Al-Ani and Keith Edwards suggested a continual evolution of team communications over time (2008, 0.35). The study participants did not indicate that the communication patterns among the product development team members altered during and after a significant change to the team environment like a joint venture or technological change. Based on the above summary, the communication skills were assumed not prone to change during the significant event and, by extension, were also assumed to not impact the team development during and after short-term Tuckman's adjourning phase.

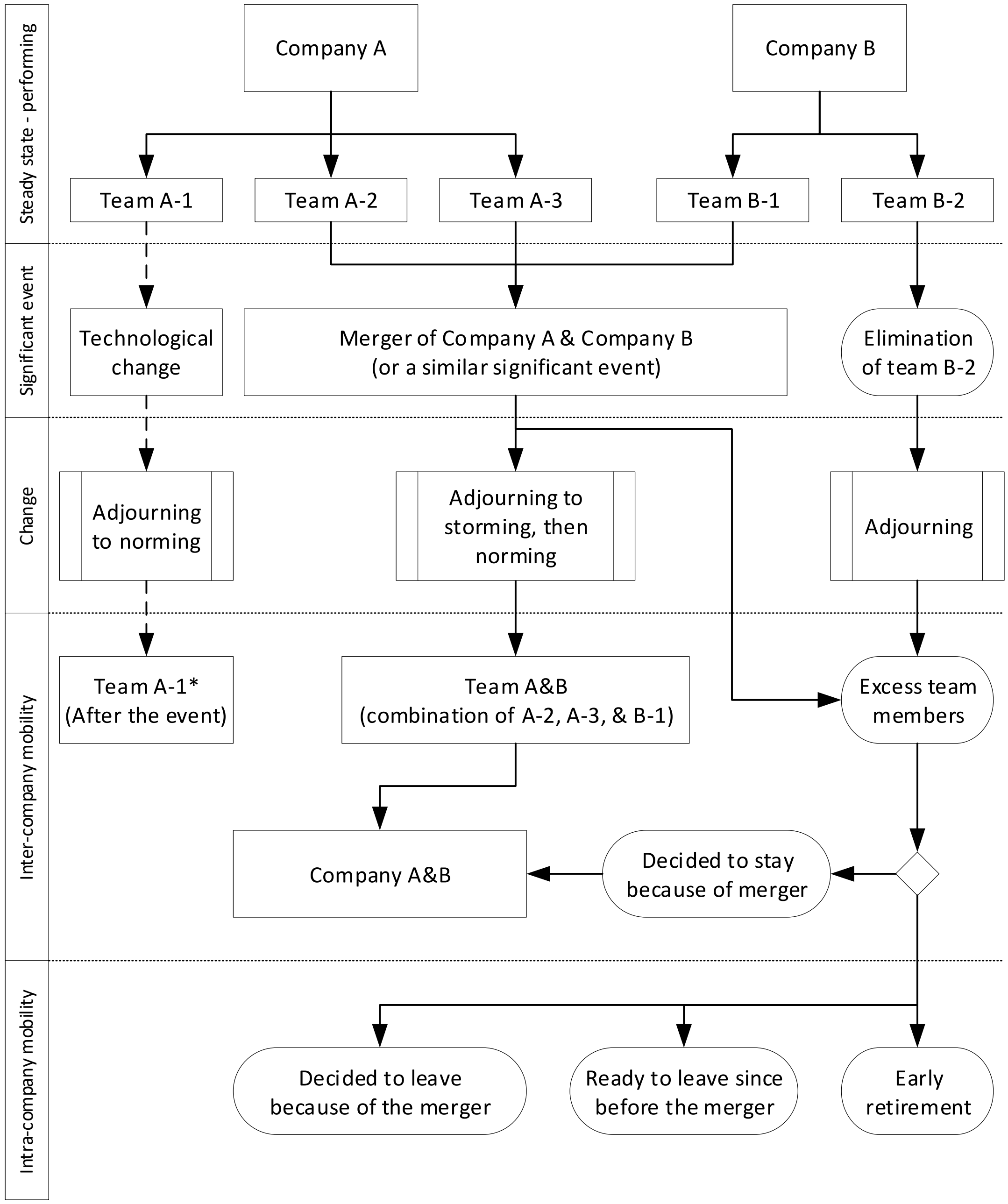


Figure 29 Input-output diagram illustrating a potential flow of the product development team members during and after the significant event

Actions-Interactions

The light metal forming industry dynamics finds their reflection in the opinions and statements provided by the study participants. Mergers and joint ventures reported in the literature (Benedyk, 2017; Henry, 2010; Schloz, 2011; Svendsen, 2017a, 2017b) are not the only types of changes experienced by the light metal forming companies. Several codes created in NVivo captured various dimensions of the type of change found in the individual interviews. Initial codes like *buyouts (P2)*, *reductions (P2)*, *mergers (P2, P6, P9, and P10)*, and *technological change (P1, P3, and P6)* became one aggregated code: *"Type of change."*

Significant event

The input-process-output diagram derived from the interviews completed for this exploratory study and presented in Figure 29 illustrates potential paths for the product development team members during and after the significant event. Only one interview *(P1)* included information about the abrupt technological change and the impact on the company and the product development team members. The details of the technological change are not part of this report due to the confidentiality agreement. The critical element of the change reported by the product development professionals is its external nature:

> *"And the reason I think the external influence is extremely important because the first instance was we all got, for lack of a better term, fat and happy. And then, all of a sudden, something comes along that just changes everything we are doing. And we weren't able to. It kind of blindsided this because we weren't aware of what was going on outside."*

The input-output diagram in Figure 29 captures the situation described by *(P1)* where Team A-1 within Company A faces the technological change that most likely changes some of the team member's behavior before they reach the steady performance level again. Team A-1 becomes Team A-1*, and the upper script star indicates that Team A adjusted their team interactions. Indeed, *(P1)* indicated that after facing the technological change that almost put the company out of business, the team members became:

> *"More attuned to listening. To what people are saying. Internally and externally. Because. Maybe? Somebody out there does have the idea, and if you're not keeping an open mind ..."*

The study participant *(P7)* described a slightly different situation where a team faced a technological change. One of the light metal forming companies was producing components with standard tolerances. The company's primary customer threatened to pull out if the quality of the product will not improve. The company's management brought this ultimatum to the team and outlined the plan on meeting the new demands while stressing the pivotal role the team members must play for the company to survive. The product development professional *(P7)* was emotional while recalling this story. This researcher could still detect the pride in the voice describing the swiftness of response, the accuracy of implementation, and the long-term impact of the reignited team interactions. Unexpectedly, *(P7)* concluded this story by saying that this success was the beginning of the firm's end. After three years of positive growth, the equity group purchased the firm, reduced the manning, and sold the most profitable parts while closing the remaining body of the firm.

The buyouts or similar situations are opposite the significant events described by the product development professionals participating in this exploratory research. In the buyout situations described by *(P2)*, the outcome for the team members was much different, as described in the following fragment of the interview:

> *"The guys that came in were confident in their ability and so on more or less first five days, four plant managers were fired, one guy – I cannot remember exactly what happened to him; they said that you are a wonderful guy, but we want to put you in the continuous improvement role and pretty much gassed all the management." (P2)*

The path of Team B-2 from Company B presented in Figure 29 illustrates that the team was eliminated due to an external event like a buyout. The members of Team B-2 most likely experience disruption in a group, possibly leading to a conflict or increased work activity or, conversely, problematic issues may be avoided, resulting in a decline in team interactions (Braaten, 1974; Tuckman & Jensen, 1977; Wheelan & Hochberger, 1996; Whittaker, 1970; Yalom, 1995). The reactions to team elimination as a result of a buyout or plant closure reported by the product development professional ranged from very emotional outbursts like *"After 40 years with this company, you let me go? What am I going to do next?" (P8)* to more speculative thinking like *"Will I fit in the new company? Will they let me continue my work?" (P7).*

The most common significant event impacting individual product development members' actions and interaction between the product development team members reported by the product development professionals were mergers and, to some extent, joint ventures.

While buyouts and technological changes could be sudden, merges and joint ventures are events taking months in preparation and potentially even more months before completion. One of the most common themes related to the product development practitioner behavior during mergers was curiosity about their prospect with the new company. In other words, after the initial shock of learning about the merger subsided, it was replaced with speculations about the short-term and long-term impact on their careers. The input-output diagram in Figure 29 illustrates the merger of Company A and Company B. Teams A-2, A-3, and B-1 merge to become Team A&B. Why not Team AB?

Consequences

The product development professional interviewed for this exploratory study indicated that after the merger of two companies representing the light metal forming industry in the USA, the product development teams from the former Companies A and B seldom became a merged new product development team. Moreover, *(P6)* reported that the company often relocated product development professionals from the plants scheduled for closing. Such offers were seldom available to the rest of the team members. Other product development professionals *(P2, P3, P5, P7, P8, and P12)* added that not many products and process development team members left the company during and right after the merger. Some team members decided to retire, and only a few left the new company.

The limited departure of the professionals from the manufacturing companies after the merger reported by the participants of this exploratory study is also present in works by other researchers (DePamphilis, 2011; Frensch, 2007; Hogg & Terry, 2000; Ivancevich et al., 1987; Keyton, 1993; M. L. Marks & Cutcliffe, 1988; Meglio & Schriber, 2020). The limited departure of the professionals evident in the interviews also profoundly impacts the formulation of the substantive theory summarizing the qualitative phase of this exploratory study.

Frensch (2007), in his work on the social side of mergers and acquisitions, indicated that *"Mergers and acquisitions often fail to generate the expected value"* and concluded that *"One of the main reasons for such failures is a lack of cooperation among employees which prevents the expected formation of synergies."* Marks and Cutcliffe (1988) indicated that a successful merger is possible by understanding the group process and support from managers participating in the merger process. Ivancevich et al. (1987) investigated strategies for managing Human Resources during mergers and indicated that the control over the sequence of actions and reactions associated with the process enables successful mergers of firms.

The Substantive Theory of Monitoring Team Interactions

"Monitoring Team Interactions" has been identified as the core category of this exploratory study. The concept denotes the actions and interactions taken by product development professionals representing the light metal forming industry in the US (in conjunction with the product development team) to maximize the chances of continuing

the career while minimizing the need for intercompany or intracompany mobility induced by external events like a merger, acquisition, joint venture, or technological change.

Monitoring Team Interactions consists of three main subprocesses: *"assessing the risks by interpreting the cues," "balancing the options for the desired outcome,"* and *"taking actions to control the risks."*

Assessing is defined as identifying and interpreting the cues leading to a definition of potential risks. The definition of the risk is perceptual rather than actual. The product development team members use communicational, informational, educational, and experience clues to assess the risks. They assess their fit with the product development team after a significant event like a merger or joint venture and their current level of vestment in the new company.

Balancing denotes considering all potential actions to continue a career and personal development with and without leaving their product development teams. The additional balancing includes the potential impact the team member will have on the future of the team development and the possible change to the team interactions resulting from potential changes to the product development team composition. The personal aspect of the balancing includes potential relocation, increased travel, and changes to the rewards.

"Taking actions to control risks" refers to the product development professionals' actions to achieve the desired outcome. The major actions-interactions taken by the product development professionals aim to reduce the risks and maximize the chances of continuing a career and limit the impact of the decision on the personal life. It is not just about staying

or leaving the company. It is a multi-dimensional problem with several outcomes that product development practitioners face during significant and external events impacting their current and most likely future team.

The Tentative Theoretical Diagram

The qualitative phase of a mixed-methods approach to investigating adjourning phase behavior in a sample of the product development teams representing the light metal forming industry in the USA ends with creating the diagram representing the relationship among the grounded theory variables derived from interviews with the product development professionals.

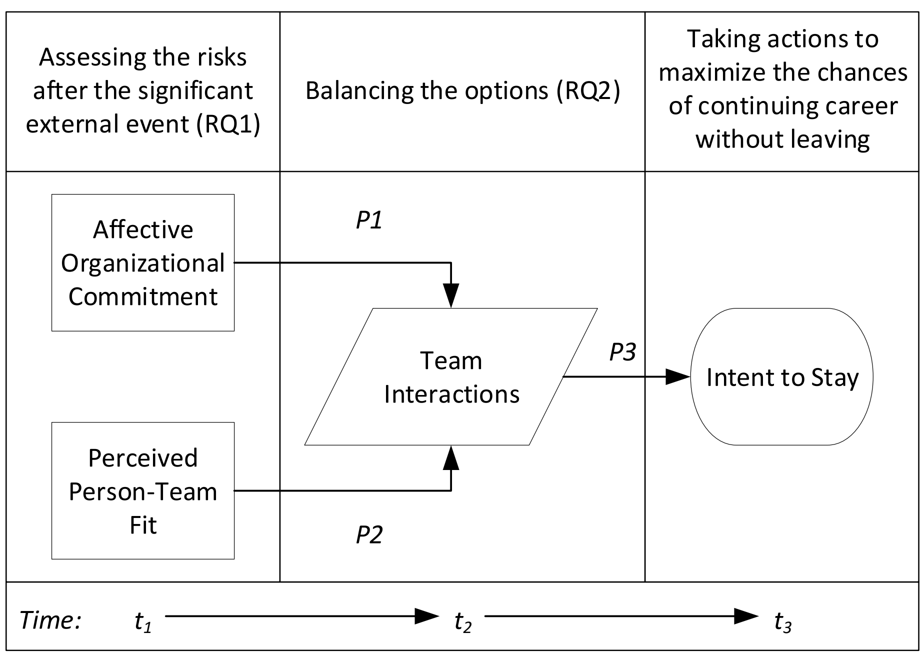


Figure 30 Diagram of the relationship among the grounded theory variables

The diagram in Figure 30 illustrates the relationship among the grounded theory variables. Two independent variables – the affective organizational commitment and the perceived person-team fit – influence the dependent variable intent to stay. The intervening variable that surfaces as a function of the affective organizational commitment and the perceived person-team fit is "team interactions." The "team interactions" result from multidepartment, multidisciplinary, and multifunctional product development team members' interacting and bringing together their multifaceted expertise in taking care of the new products from the cradle to the grave.

This relationship helps us understand how the intent to stay can result from having a broad product development team. The intervening variable "team interactions" surfaces at time t_2 as a function of the affective organizational commitment and the perceived person-team fit, which were in place at time t_1, to bring about the intent to stay in time t_3. The intervening variable of "team interactions" and its component discussed later in this section help us to conceptualize and understand how the vestment of the product development practitioner operationalized through the affective organizational commitment and the perceived person-team fit of the same product development practitioner results in high intention to stay with the organization during and after significant events like technological changes, joint ventures, and mergers.

Propositions

A set of propositions for testing is the last methodological result of the qualitative phase of this exploratory study. Sekaran (2003) suggested that non-directional hypotheses are adequate for relationships or differences in never-explored situations (p. 105). Such an approach potentially reduces bias in indicating the direction (Sekaran, 2003). On the other hand, this researcher followed the Straussian approach while conducting the grounded theory research and used Strauss's (1987) recommendations on using the trajectories to approximate the potential mechanism existing between categories established during axial coding interviews. The trajectory has a starting point and a direction. Finding the destination's coordinates is at the heart of the exploratory study.

The following propositions, funded on the results of the qualitative phase of this study, served as a guiding light during the framework development described in the following section of this chapter:

> *Proposition 1: The higher the affective organizational commitment of the product development team members, the more positive the team member interactions <u>during</u> the significant event*

> *Proposition 2: The higher the perceived person-team fit of the product development team members, the more positive the team member interactions <u>during</u> the significant event*

Proposition 3: The greater the team interactions among the product development team members during the significant event, the higher the intent to stay after the significant event

Framework development

In the mixed-method approach, the framework development requires a tentative theoretical model. The outline of procedures leading to the development of the model and its digital twin created in NVivo 12 are presented in Figure 7 and Figure 17, respectively. The essential strategy for achieving a tentative theoretical model was memo writing, as proposed by Strauss (1987, pp. 208-214). Table 5 contains some information on the framework development memos completed by the author.

After securing the IRB clearance for human participation research (see Appendix B for details), the author scheduled and completed the initial interviews as described earlier in this chapter and indicated in Figure 7. Birks and Mills (2015) showed that memo writing is indispensable when working on the grounded theory and the memos on the theory writing and theory building were initial notes written while transcribing the interviews. These notes were brief and began to capture some inter-interview and intra-interview links.

Table 5 Summary of framework development memos completed by the author

Date	*Memo title*	*Completed interviews*	*Framework Codes per interview*	*Framework References per interview*
5/29/2021	001-Theory writing 01	1	0	0
6/19/2021	011-Theory building 01	2	0	0
6/19/2021	013-Theory building-disfunctions 02	2	1	1
7/11/2021	035-Theory building 05	5	0	0
7/20/2021	036-Theory building 06 - Paradigm	5	0	0
7/20/2021	037-Theory building 07 - Actions-Interactions	5	2	2
7/20/2021	039-Theory building 08 - Micro and macro-conditions	5	1	1
8/04/2021	043-Theory building 09 - Healing time	7	1	1
8/05/2021	044-Theory building 10 - Change in attitude	7	2	2
8/05/2021	045-Theory building 11 - Proactive crisis management	7	6	6
8/06/2021	046-Theory building 12 - Speed of communication	7	6	6
10/17/2021	076-Theory building 13 - Mobility score	9	2	2
10/23/2021	080-Theory building 14 - The model	11	6	6
11/11/2021	081-Theory building 15 - The flow chart	13	7	7

Scale development

In general, the framework for developing the Team Interactions Scale followed the first five steps for developing a measurement scale identified by DeVellis (2017, pp. 105-153):

(1) determine what you want to measure, (2) generate an item pool, (3) determine the format to measure, (4) have experts review the initial item pool, and (5) consider the inclusion of validation items. The remaining three steps are: (6) administering items to the development sample, (7) evaluating the items, and (8) optimizing scale length (DeVelllis, 2017).

Determining what to measure impacts the rest of the scale development process and must be well-grounded in the substantive theories of the phenomenon under investigation and consider the relevant social science theories before developing a scale to measure elusive phenomena escaping direct observations (DeVelllis, 2017). This author used the Straussian approach to the product development team's exploratory study during the externally induced adjournment phase and proposed a Substantive Theory of Monitoring Team Interactions. The concept denotes the actions and interactions taken by product development professionals representing the light metal forming industry in the US (in conjunction with the product development team) to maximize the chances of continuing the career while minimizing the need for intercompany or intracompany mobility induced by external market events, like a merger, acquisition, joint venture, or technological change. The concept rests on four major categories: (1) organizational commitment, (2) person-team fit, (3) intentions to stay, and (4) team interactions. The author followed De Vellis's (2017) recommendations and completed an additional literature search on organizational commitment, person-team fit, and team interactions. The main objective of the additional literature search was the identification of well-established instruments for potential utilization during the quantitative phase of this research.

The number and length of interviews written after analysis of the consecutive interviews increased with time. More importantly, the ideas captured with the memos were coded more often and served as a reference while constructing the tentative theoretical model. Information presented in Table 5 shows how much the number of codes and references per interview changed as this researcher progressed with data analysis extracted from interviews with the product development professionals representing the light metal forming industry.

Instrument development

Creswell and Plano Clark (2018, p. 193) suggested locating and using published instruments that best match different qualitative themes. Unfortunately, the literature search did not present a scale designed to probe the product development team behavior during the adjourning phase of Tuckman's team development model. In a situation like that, Creswell and Plano Clark (2018, p. 194) recommended that the researchers pay special attention to emergent quotes, codes, themes, and features that suggest a new variable and inform the selection, modification, or design of an instrument to measure that variable. Finally, Creswell and Plano Clark (2018, p. 195) advised creating a diagram of the overall procedures in a mixed-methods study.

This researcher followed Creswell and Plano Clark's (2018) recommendations, tracked the potential links between the main qualitative findings and the quantitative features, and created a chart in Figure 31 that includes the main procedures for an exploratory sequential study with instrument development envisioned for this study. Secondly, this researcher completed an extensive literature search for scales and instruments designed to investigate the major categories identified during qualitative data collection and analysis: (1) commitment, (2) fit, (3) interactions, and (4) intentions. The literature search yielded description, reliability, validity, and items information for each scale and instrument. It also included information about the source, citations, and potential modifications. The validity section had information on the groups used during the original scale or instrument development.

Instruments selected for the study

The following three sections describe the process of selecting the correct scale for measuring (1) organizational commitment, (2) person-team fit, and (3) intentions to stay. Each section includes the methodological results like interview results and quotes indicating what the scale must measure. Brief literature review results for selected scales include the scale type and the nature of the measure. The summary of scale selection includes the unidimensional reliability results indicating the level of coefficients alpha and omega calculated using the survey data. This researcher did not complete the confirmatory factor analysis for any instruments used in this study. Instead, this researcher cited work by other scientists that worked with teams representing fields similar to the light metal forming and completed the confirmatory factor analysis for the instruments used in this study (Ashforth, 1989; Hackman & Oldham, 1980; Kacmar et al., 1999; Verquer, Beehr, & Wagner, 2003).

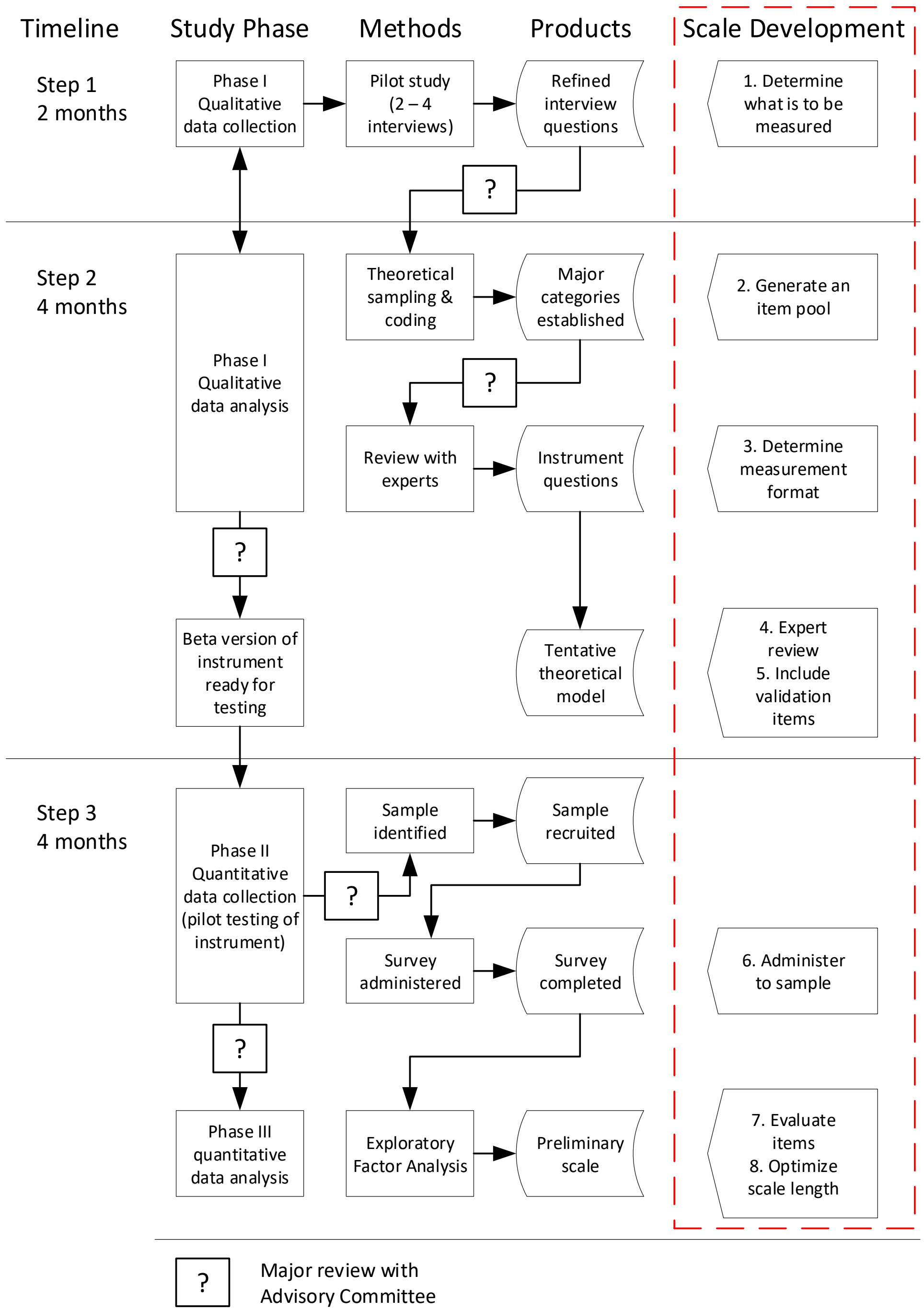


Figure 31 Instrument design steps within an exploratory sequential study (Dashed outline)

Organizational Commitment – Scale selection

The organizational commitment category emerged very early in the interviews collected and analyzed for this study. The participants indicated how a *"sense of belonging"* developed among the team members after surviving several significant. One of the product development professionals described the consolidation of the team in the following way:

> *"I have been in environments where we went through a couple of buyouts, like three buyouts in five years, and it actually sorts of gel the team in the way of survivors. We had a vested interest in being more open and more collaborative in order to be successful." (P2)*

Another dimension of the organizational commitment was a *"sense of constancy"* desired by the product development professionals. The following interview fragment puts the constancy in the context of a significant event and its potential impact on the team development:

> *"In the first, buyout, right, wrong, or different, we were basically got sold to private equity, and they pretty much kept in place the management team that we had. Certainly, new people came in, but there was a constancy, and there was a message on what we were doing, and other companies were bought, and it was more about how to integrate it in." (P6)*

The organizational commitment dimensions like belonging *(P2)*, constancy *(P1, P2, P4, P6, P12, and P13)*, and a sense of camaraderie *(P2, P0, and P14)* are some characteristics of affective reactions of employees to the organization (A. Cohen, 1993). Fields indicated that employees with a robust affective commitment continue employment because they want to do so (2013, p. 43). Two other dimensions of organizational commitment identified by Fields (2013) are continuance commitment and normative commitment. The continuance commitment is typical for employees that remain with their employer because they need to do so, while the employees with a high level of normative commitment feel that they ought to remain with the organization. The interviews did not indicate that the product development professionals, representing the light metal industry in the USA, desire to continue their employment at any cost. The results indicated that some of the product development professionals interviewed for this study see the significant event as an opportunity to re-evaluate their current position, including the current team interactions, and eventually continue with their current employers because they want to.

This researcher reviewed several measures of organizational commitment. The interview analysis results indicate a change in the attitude, thus narrowing the search to instruments designed to measure affective commitment because once the affective commitment is in place, employees may find mechanisms for adjusting (Mowday et al., 1979; Mowday & Sutton, 1993). The instrument selected for capturing the affective component of the organizational commitment among the product development professionals is the Organizational Commitment Questionnaire (OCQ), developed by Porter, Crampon, and Smith (1972) and codified by Mowday, Steer, and Porter (1979), that defines organizational commitment as the relative strength of an individual’s identification and involvement in a particular organization.

When defined in this fashion, commitment represents something beyond mere passive loyalty to an organization (Mowday et al., 1979, p. 226). It involves an active relationship component possibly necessary for employees to evaluate their organizational commitment after the organization experiences change induced by external processes like joint venture, merger, or a significant technological change. The active component increases the definition of the organizational commitment beyond job satisfaction and into a general affective response to the whole organization (Mowday et al., 1979, p. 226).

The OCQ uses 15 items to describe organizational commitment (see Appendix H for details). Responses are using a 7-point Likert scale where 1 = *strongly disagree*, 2 = *moderately disagree*, 3 = *slightly disagree*, 4 = *neither disagree nor agree*, 5 = *slightly agree*, 6 = *moderately agree*, and 7 = *strongly agree*. Summed results divided by 15 yields a summary indicator of employee commitment. Negative phrasing and reverse coding of several items reduce response bias. Mowday et al. (1979) intended that the scale items would provide a fairly consistent indicator of employee commitment levels for most working populations (p. 227). The confirmatory factor analysis by Kacmar et al. (1999) demonstrated that the one-factor model fit the data better. Dunham et al. (1994) found in a multi-sampling confirmatory factor analysis that the 15 items of the OCQ loaded with the eight affective commitment items of the Meyer and Allen (1997) affective commitment scale.

The final step in selecting OCQ for this study was the reliability test using available survey data. The OCQ survey data collected from various teams representing the product development teams in the light metal forming industry and participating in this study served as an input in the unidimensional reliability test using JASP (Gross-Sampson, 2019; Love et al., 2019). Internal consistency of a scale typically uses Cronbach's coefficient alpha (Cronbach, 1951), and it serves as a widely accepted measure of reliability (DeVelllis, 2017, pp. 43–59). An alternative reliability estimate is coefficient omega (Dunn, Baguley, & Brunsden, 2014; Hayes & Coutts, 2020). Whereas alpha derives variance estimates from the covariance (or correlation) matrix of the items making up a scale, omega uses a matrix of item loadings on the one common factor the items share (DeVelllis, 2017, p. 59). The difference in value between coefficients alpha and omega does not indicate a difference in reliability for the same scale. This difference indicates that different metrics can have different values for the same scale.

Table 6 Unidimensional Reliability results for the OCQ scale

Estimate	*McDonald's ω*	*Cronbach's α*
Point estimate	0.885	0.879
95% CI lower bound	0.839	0.824
95% CI upper bound	0.930	0.920

N = 54
Literature recommended McDonald's ω > 0.700
Literature recommended Cronbach's α > 0.700

The unidimensional reliability results for the OCQ presented in Table 6 indicate that coefficients alpha and omega calculated using the survey data exceed the recommended values of 0.700. In summary, the 15 items OCQ scale by Mowday et al. (1979) selected for this study meets the requirement for measuring the affective commitment among product development professionals representing the light metal forming industry in the USA.

Person-Organization Fit – Scale selection

While the organizational commitment should be somewhat stable over time (Mowday et al., 1979, p. 226), the person-organization fit is a more dynamic individual's response to work situations (O'Reilly III, Chatman, & Caldwell, 1991). The dynamic aspect of fit is prominent in studies of organizational stress, where measures must recognize individual differences in the cognitive appraisal of the situation (Akkaya & Serin, 2020; J. R. Edwards, 1996; Vilela, González, & Ferrín, 2008; Vogel & Feldman, 2009). Conversely, the match between person and organization could increase if the change opens a new venue for the employee to explore without leaving this environment.

The product development professionals interviewed for this exploratory study of the team members' behavior during Tuckman's adjourning phase of the team development indicated several dimensions of the person-organization fit. *"Design for fit"* is one of the categories established after studying the participant's responses to questions about the composition of an "ideal" product development team. One of the study participants expressed this condition in the following statement:

> *"I am responsible for putting an organization together that has the right individuals with the right competencies, with the right abilities to interact both within a team and within a company and to some degree externally" (P2)*

The study participants were encouraged to propose as many characteristics of the "ideal" product development team as they wanted. The next question of the interview was about these characteristics within their product development teams. Surprisingly, both lists of characteristics were short, including but not limited to *adaptability, competencies, curiosity, communication skills, attitudes towards company policies and values,* and *individualism*.

This researcher revised several instruments for measuring person-organization fit and selected the Perceived Person-Organization Fit (PP-OF) by Lovelace and Rosen (1996) for this exploratory study. The PP-OF uses 14 items derived from literature and deemed necessary to assess perceived person-organization fit by directly asking respondents for the degree of fit between their values, ethics, goals, and objectives and the same values for the organization (Lovelace & Rosen, 1996). Responses are using a 7-point Likert scale where 1 = *very poor fit*, 2 = *poor fit*, 3 = *slightly poor fit*, 4 = *neither poor nor good fit*, 5 = *slightly good fit*, 6 = *good fit*, and 7 = *very good fit*. The mean of the 14 items comprised the overall perceived fit scale. Appendix I includes the PP-OF instrument.

Table 7 Unidimensional Reliability results for the PP-OF scale

Estimate	*McDonald's ω*	*Cronbach's α*
Point estimate	0.840	0.840
95% CI lower bound	0.777	0.767
95% CI upper bound	0.903	0.894

N = 54
Literature recommended McDonald's ω > 0.700
Literature recommended Cronbach's α > 0.700

The work by Lovelace and Rosen (1996) on the person-organization fit continues to inspire new researchers conducting exploratory studies of group performance (Elfenbein & O'Reilly III, 2007), employee outcomes (N. Da Silva et al., 2010), or completing a meta-analysis of relations between person-organization fit and work attitudes (Verquer et al., 2003).

The unidimensional reliability results for the PP-OF presented in Table 7 indicate that coefficients alpha and omega calculated using the survey data exceed the recommended values of 0.700. In summary, the Perceived Person-Organization Fit scale by Lovelace and Rosen (1996) meets the requirements for use in this exploratory study of potential behavioral changes observed in the product development team members during Tuckman's adjourning phase of team development.

Intention to stay – Scale selection

Based on the information found in the interviews collected for this exploratory study, most product development professionals indicated feeling unsettled or even experiencing some fear after learning that their company will be going through a merger or joint venture:

> *"And I mean, it's obviously there's always some uncertainty when you do those kind of merges about who's going to which team is going to be doing what, and which team is going to take certain subjects. But I think the biggest challenge was that kind of stuff almost like questioning our fears a little bit. Damn, that can be I. I found that a bit unsettling." (P6)*

Sometimes the fear could lead to a sort of paralysis, as in the following interview fragment where the product development professional is describing how the team leaders could impact the team during times of the significant event:

> *"The other outcome, of course, and there are many, is paralysis. Where there is a lot of fear about what would happen to me with these changes, why are these changes happening to me, inability to move around, and that is the one of the big challenges for a leader when you are going through those changes is how to shepherd and lead the team in through to what could be exciting new times, but it could be." (P2)*

The above descriptions share some characteristics with the "fight or flight" as a human response to a threat (Cannon, 1922). Interestingly, none of the interviews indicated an exodus of the product development team embers after the company announced the joint venture or merger. Mental freezing or paralysis could also serve as a precursor to unfreezing before the social change, possibly resulting from a joint venture or merger, is followed by refreezing (Lewin, 1947). Again, the product development professionals did not indicate that the product development team members were dormant before the change, active during the change, and dormant after the change. On the contrary, the product development professionals indicated that the product development team members see the joint venture or a merger as an opportunity and that these professionals will evaluate how much influence they could have over the team development direction and how constrained they could become before deciding between staying or leaving the company. By taking the above summary into account, this researcher decided to select a scale designed for studying team member's intention to stay with the organization rather than leave the organization.

Change in the team member empowerment resulting from the extrinsic change to the team environment could impact team members' decision of staying with the team. The scale selected for this exploratory study uses two out of four dimensions of empowerment proposed by Spreitzer (1995). The dimensions used in this research are "Self-determination" and "Impact. The remaining scale elements, "Meaning" and "Competence," are not included. The OCQ captures some characteristics of these elements already. Spreitzer (1995) did not design scales for individual dimensions but adopted self-determination items from Hackman and Oldham's (1985) autonomy scale and selected the impact items from Ashforth's (1989) helplessness scale (p. 1451).

The Intention to Stay (ITS) scale uses six items derived from the literature (Ashforth, 1989; Hackman & Oldham, 1980; Spreitzer, 1995) necessary to assess a perceived person's intent to stay by directly asking respondents about their level of self-determination and impact on the organization. Responses are using a 7-point Likert scale where 1 = *strongly disagree*, 2 = *disagree*, 3 = *slightly disagree*, 4 = *neither disagree nor agree*, 5 = *slightly agree*, 6 = *agree*, and 7 = *strongly agree*. The sum of responses for individual dimensions is divided by two to arrive at the intention to stay score. Appendix J includes the ITS instrument.

The unidimensional reliability results for the ITS presented in Table 8 indicate that coefficients alpha and omega calculated using the survey data exceed the recommended values of 0.700. In summary, the Intention to Stay scale derived from the Psychological Empowerment scale by Spreitzer (1995) meets the requirements for use in this exploratory study of potential behavioral changes observed in the product development team members during Tuckman's adjourning phase of team development.

Table 8 Unidimensional Reliability results for the ITS scale

Estimate	*McDonald's ω*	*Cronbach's α*
Point estimate	0.909	0.917
95% CI lower bound	0.871	0.873
95% CI upper bound	0.946	0.947

N = 54
Literature recommended McDonald's ω > 0.700
Literature recommended Cronbach's α > 0.700

Team Interactions – Scale development

Even the most adequately designed product development team will not perform without proper management and coordination of their efforts (Hackman, 2002). High-performing teams are not enough to create high overall product development results (Belliveau et al., 2002). However, good teams are a precondition, both directly and indirectly, to the success of product development efforts (Sivasubramaniam et al., 2012). On the other hand, a failing team is likely to kill any project, regardless of its initial promising performance (Lencioni, 2012).

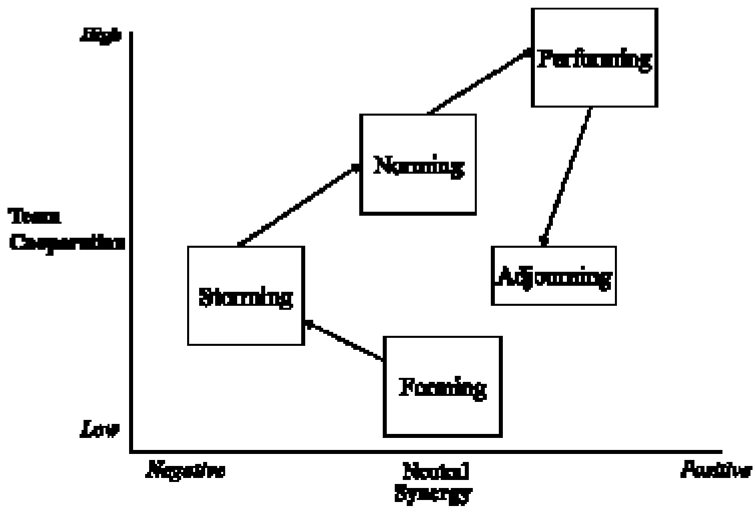


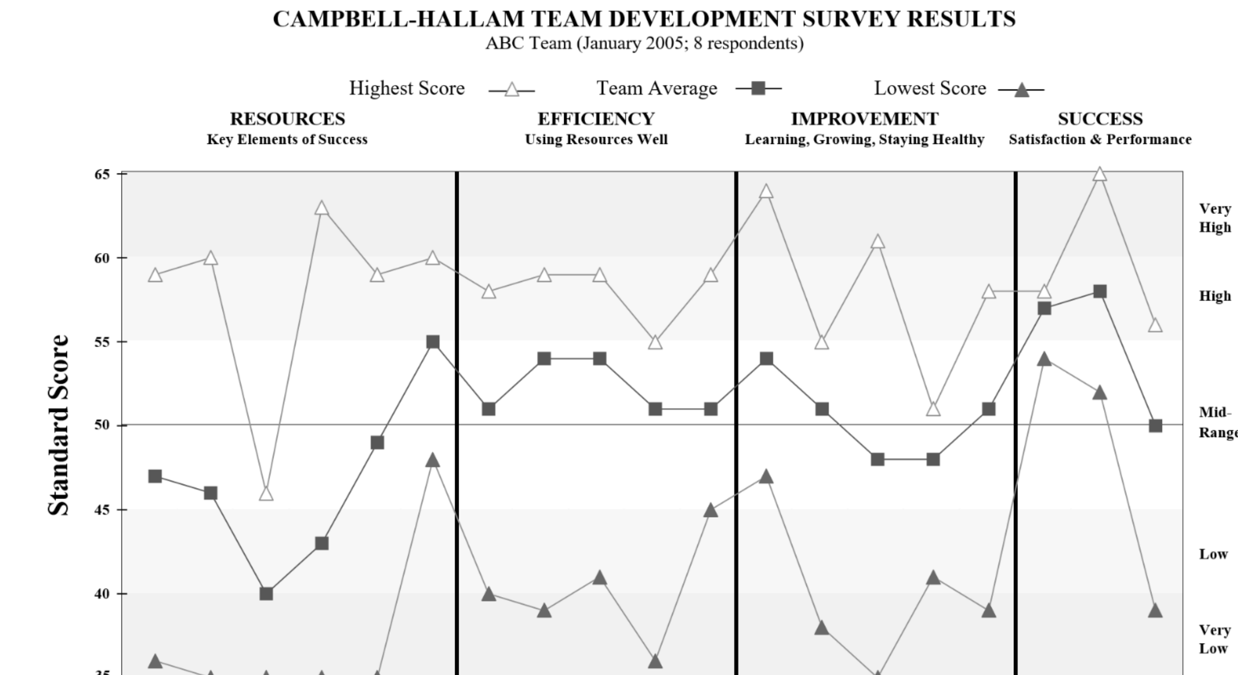
Figure 32 Visualization of the Five Stage Model (Robbins & Judge, 2013)

Team cooperation, defined as how team members feel they are doing a good job together, can be analyzed at each stage of the product development process (Leenders et al., 2002). Leenders et al. (2002) argued that in a successful product development team, the level of cooperation should increase over the project's lifetime. Leenders et al. (2002) also reasoned that integration among team members, referring to an even distribution of communication over the team members, is another measure of the product development team performance. Robbins and Judge (2013) echo the team cooperation and synergy argument of Leenders et al. (2002) and visualize the Five Stage Model as a function of team cooperation and synergy presented in Figure 32. The most significant observations are that team cooperation increase with the team tenure increase, and sudden team cooperation decrease during the adjourning phase (Robbins & Judge, 2013).

Review of existing instruments

Leenders et al. (2002) created Team Spotter's Guide (TSG) to assess how cooperative are the team members and if they work together well across functions without flocking together in subgroups. The TSG uses 16 statements to assess team cooperation and integration over time. The TSG uses a convoluted method for collecting and processing data before arriving at the score for team cooperation. Unfortunately, there is no information published on the reliability of TSG. Moreover, this researcher could not locate additional information about TSG in the available literature. Under these circumstances, the TSG is not the correct scale to support this exploratory study of the product development team's performance during an externally induced change like a joint venture or merger and acquisition.

Wheelan and Hochberger (1996) described the theoretical underpinning, construction, and validation for a scale specifically designed to measure group development processes. The stages of the Wheelan-Hochberger model are (1) dependency and inclusion, (2) counter dependency and fight, (3) trust and structure, (4) work, and (5) termination. Wheelan and Hochberger (1996) note that even continuous institutional groups like product development teams experience various endings like task completion, team members' retirement, company mergers, or firm closing. Impending termination alters a group's structure, and regression to earlier stages is possible (Bion, 1951; Garland et al., 1978; Yalom, 1995). Despite including the termination phase in their model, Wheelan & Hochberger (1996) did not include it in the Group Development Questionnaire (GDQ).



	TIME AND STAFFING *We have enough time and people*	INFORMATION *We get the information we need*	MATERIAL RESOURES *We have the right tools and space*	ORGANIZATIONAL SUPPORT *Our organization supports us*	SKILLS *We are skilled*	COMMITMENT *We work hard*	MISSION CLARITY *Our purpose is clear*	TEAM COORDINATION *We are organized and efficient*	TEAM UNITY *We work together in harmony*	INDIVIDUAL GOALS *I have clear goals*	EMPLOWERMENT *We are trusted and supported*	TEAM ASSESSMENT *We seek ways to improve the team*	INNOVATION *We try new and different approaches*	FEEDBACK *We learn how we are doing*	REWARDS I am rewarded for doing well	LEADERSHIP *We have effective leadership*	SATISFACTION *I like being on this team*	PERFORMANCE *We are performing well*	OVERALL INDEX
Team Average	47	46	40	43	49	55	51	54	54	51	51	54	51	48	48	51	57	58	50
Low	36	35	26	32	30	48	40	39	41	36	45	47	38	34	41	39	54	52	39
High	59	60	46	63	59	60	58	59	59	55	59	64	55	61	51	58	58	66	56

Figure 33 An example of a TDS scorecard (Hallam & Campbell, 1997)

Two reasons cited by Wheelan and Hochberger (1996) for not including the fifth scale to measure the termination phase of group development are (1) the instrument was not designed for use with continuing groups, and (2) the termination phase of group development has insufficient empirical validation to be included in an instrument at the time of publication. After completing the above review, this researcher concluded that despite its excellent design and substantial support from published work, the GDQ is not an adequate instrument for use in this exploratory study.

Campbell and Hallam (1998) proposed the Team Development Survey (TDS) to measure team members' perceptions and use this information to identify the team's strengths and weaknesses. The TDS is a collection of 18 short scales designed to measure a team's needs and effectiveness. The TDS consists of 72 specific statements and uses a six-point Likert scale ranging from *strongly agree* to *strongly disagree* (Hallam & Campbell, 1997, p. 156)

An example of the Campbell-Hallman TDS scorecard presented in Figure 33 includes the overall TDS Index for the team. On the other hand, there is no discussion on the TDS validation, including the Exploratory Factor Analysis or Confirmatory Factor Analysis. Campbell and Hallam (1996) stated that the TDS is a helpful tool because it provides a response to the difficult question, *"How are we doing?"* Such a statement is not enough to include the TDS in this exploratory study of team interactions during Tuckman's adjourning phase of the team development.

Further literature analysis led to the conclusion that there are many definitions and measurements of team performance; however, a consistent definition for group interactions is still missing. Operalization of team interactions, understood as team performance, is generalized as task effectiveness or team productivity (Gruman & Saks, 2011). Examples of measures of team productivity include financial performance (ROI, margins, time to break even), product-level performance (product cost, time to launch, quality guidelines), and customer acceptance measures (customer satisfaction, revenue, market share) (Crawford & Di Benedetti, 2008). However, researchers interested in predicting product development teams' performance should consider interpersonal processes (M. A. Marks et al., 2001). Interpersonal processes are more likely to influence team cohesion over time, which is one of the antecedents of team tenure and satisfaction (Huckman et al., 2012).

There are numerous models of team performance (Braaten, 1974). Each of these models proposes several variables that, according to the authors, influence the effectiveness of teams. Some models highlight teamwork training (Mcewan, Ruissen, Eys, Zumbo, & Beauchamp, 2017) and other group efficacy (Gibson, 2016). Still, others emphasize external factors like the company's culture (Felipe et al., 2017). One of the most unusual team effectiveness models assumes that all teams can be dysfunctional (Lencioni, 2012). According to the author, it is critical to understand the type and level of dysfunction before improving the functioning of a team. Lencioni (2012) used a pyramid to demonstrate the hierarchical progression of team development. The five levels are similar to the levels included in Maslow's Hierarchy of Needs Theory (Maslow, 1943).

There are five potential dysfunctions of a team in Lencioni's model: (1) absence of trust, (2) fear of conflict, (3) lack of commitment, (4) avoidance of accountability, and (5) inattention to results. The Lencioni Team Assessment tool provides insight into the team's unique strengths and areas for improvement against the Lencioni model of five dysfunctions. Lencioni (2012) suggests that the whole team complete the assessment for a more accurate analysis. Unlike the Team Spotter's Guide, the Lencioni Team Assessment can serve as a starting point for discussing the team's performance and potential actions for improvement. Unfortunately, there are no publically available studies on the validity and reliability of Lencioni's model available for review. On the other hand, the items for Lencioni's scale are available for review (Lencioni, 2012).

Determination of items

This researcher focused on the interpersonal processes (Huckman et al., 2012) while creating a new scale by following De Vellis's (2017) approach outlined in the introduction to this section. The general approach to scale creation and validation proposed by De Vellis (2017) included the principles for measuring teamwork by Baker and Salas (1997) listed in Appendix K. As indicated in the introduction, this study used several theories, models, and perspectives from the field of Organizational Behavior. The Open System perspective by James D. Thompson (1967) served as a background perspective while exploring how the change to the external firm's environment could change the organization, specifically the outputs, including the employee behavior.

Lencioni's model (2012) fits with the selected background perspective, and some of Lencioni's scale items served as a base for the team interactions scale created during the quantitative phase of this mixed-methods exploratory study. According to Lencioni, it is critical to understand the type and level of dysfunction before improving a team's functioning. Lencioni (2012) used a pyramid to visualize the hierarchical progression of team development. The five levels are similar to Maslow's Hierarchy of Needs Theory (Maslow, 1943). There are five potential dysfunctions of a team in Lencioni's model: (1) absence of trust, (2) fear of conflict, (3) lack of commitment, (4) avoidance of accountability, and (5) inattention to results. The Lencioni Team Assessment tool provides a sense of a team's unique strengths and areas for improvement against the Lencioni model of five dysfunctions of a team. Lencioni (2012) suggested that the whole team complete the assessment for a more accurate analysis.

In this exploratory study, selecting the items for the potential scale started during the analysis and coding of the first interview. This process of selecting items is congruent with Creswell and Plano Clark's (2018, p. 194) recommendation that the researchers must pay special attention to emergent quotes, codes, themes, and features that suggest a new variable and inform the selection, modification, or design of an instrument to measure that variable.

The *team interactions* were among the final categories emerging from the interviews with the product development professional representing the light metal forming industry. The team interactions category rests on *openness*, *trust*, *collaboration*, and *communication*. In the following example, the product development professional provided an opinion on how some of the elements of the team interactions category can interplay:

> *"I do think that, from the value standpoint, if you are not honest, you lose the trust of people when it is extremely hard to rebuild that trust. But I do think that openness is, generally speaking, to the degree you can be, the best policy because*

in the end, at least from my viewpoint, whether I kept the job on not, I can relate this to things in my personal life. I do not know if I would use the word regrets, but when I have reexamined things that I have done, or maybe I was not as open I could have been, maybe I did not perceive that at that time. More often than not, it bothered me or caused problems for the organization." (P6)

Another product development professional described some of the product development team interworking when solving a problem through collaboration:

> *"I would meet with them, usually with another engineer, just to have a second set of eyes and ears. And we will discuss either how, what the purpose of that product is, some of the constraints that the product has to have that need to be accommodated for in the manufacturing process if they are manufacturing, how they are doing it, potentially. And some of the improvements and goals of the overall project that they like to see." (P3)*

The *communication* dimension of the team interactions category is not the same as the *communication skills* of the person-team fit category. During the interviews, *communication skills* emerged as one of the product development team member's characteristics, earning them a position on the product development team. On the other hand, the *communication* dimension encapsulated several aspects of team members' interactions while solving a problem, presenting an idea, or participating in the meeting.

Generation of items pool

Based on the above summary and by following other scholars' recommendations (D. P. Baker & Salas, 1997; de Vaus, 2002; DeVelllis, 2017; Fowler, 1995, 2014; Wiley, 2010) and using Lencioni's (2012) scale items, this researcher created a team interactions list presented in Table 9. Appendix L includes the complete list of Lencioni's items, with items selected for the new team interactions scale highlighted yellow.

Table 9 Team Interactions items

Item no.	*Item details*
55	Team members acknowledge their weaknesses to one another.
59	Team members ask for help without hesitation.
62	Team members ask one another for input regarding their areas of responsibility.
65	Team members are quick to confront peers about problems in their respective areas of responsibility.
69	Team members question one another about their current approaches and methods.
82	Team members can comfortably discuss their personal lives with one another.
84	Team members consistently follow through on promises and commitments.
85	Team members offer unprovoked, constructive feedback to one another.

The proposed Team Interactions scale reflects the main dimensions of the *team interactions* category arrived at during coding the interviews. This scale also echoes some of the between-the-line sub-dimensions detected by this researcher. For example, item no. 82 – "Team members can comfortably discuss their personal lives with one another" does not appear in the body of the interview transcript. On the other hand, this researcher started each interview with a friendly exchange before the actual interview began. Similarly, after asking the final interview question, this researcher invited interviewees to ask him questions. These informal sections of the interview were not a part of the initial version of the interview transcript. After transcribing these sections of the interviews, the new codes capturing the intimate nature of provided information emerged and served as a starting point for creating items no. 55, 82, and 85.

Another category that puzzled this researcher was *individualism,* defined as a specific characteristic of the product development team member. The product development professionals were clear in their opinion about team members exhibiting a high level of *individualism*:

> *"We do not want people to be curious about how just can randomly change this process because I like to make it better even though we spend five years developing it. Something of that nature" (P7)*

> *"I believe about 10% of the population has borderline personalities. Uh, which stress communications, and some of those 10% people are incredibly intelligent. Technically. Ah, but they are horrible to have in an organization." (P5)*

The immediate reaction to the above statement would be to search for a scale measuring various aspects of individualism in team members and include it in the survey. Such an action would extend the survey and generate data suitable for studying the potential link between the detected level of individualism and other team characteristics like a team-person fit or organizational commitment. While such a link is an exciting area of study, it did not surface as a category during coding interviews with the product development professionals. The constant comparison of the coded and new information recommended by Corbin and Strauss (2018) led this researcher to assume that *individualism* could be a synonym for conflict between team leaders and members. The detailed review of memos and notes accompanying each interview provided additional statements by the product development professionals while speaking about team members with a high level of *individualism*. Some of these statements are *"individualistic in their approach to things," "not willing to share," "not transparent with the results," "do not ask for help,"* and *"not open to receive feedback."* This researcher used a "positive" version of these statements while selecting items no 59, 62, and 65 from Lencioni's scale (2012).

Review by experts

The primary review points indicated in Figure 31 were not the only review sessions during this exploratory study. The researcher kept the research journal to capture the progress and findings while studying the product development teams representing the light metal forming industry in the USA. Information from the research journal, memos written while processing the quantitative data, and various charts created while integrating information served as a starting point for scheduled and ad-hoc meetings with the advisors. The initial pool of items was a topic of several meetings during which the initial pool of items morphed into a Team Interactions scale presented in the previous section. The advisors provided the additional evaluation of the initial pool of items and helped this researcher firm up the definitions of the final set of items before testing the scale.

Before completing the remaining scale development steps, this researcher conducted another literature search to determine if other scholars already reported scales similar to the Team Interactions Scale. Not surprisingly, there are many reported scales for assessing various dimensions of teamwork; however, most of the instruments presented in the literature focus on one of the four items identified by this study participants. Cooper et al. (2010) developed a teamwork assessment measure for emergency resuscitation and team performance (TEAM). Team communication constitutes the body of the TEAM instrument, while items like trust and openness are not among the teamwork dimensions assessed by the TEAM (S. Cooper et al., 2010). Another example of the instrument developed specifically for the medical field is the Team Performance Scale (TPS) by Thompson et al. (2019). The TPS is a 16 items quick measure of the quality of the interactions within teams over a course duration (B. M. Thompson et al., 2009). The TPS does not include questions of intimate nature characteristics for the product development teams and is more suitable for use with teams with known life spans.

Most of the instruments described in the literature cover some of the items selected for the Team Interactions Scale proposed in this study. Additionally, the available instruments are mainly for teams with a specific life span and administered at the end of the team life before the team dissolves. The nature of the product development teams investigated in this study is continuous, meaning that the teams continue working after significant extrinsic events like joint ventures, mergers, acquisitions, or technological change.

Format for measurement

The Team Interactions Scale (TIS) uses eight items listed in Table 9. Responses are using a 5-point Likert scale where 1 = *almost never*, 2 = *rarely*, 3 = *sometimes*, 4 = *usually*, 5 = *almost always*. No questions in the TIS were reverse coded to keep the same direction of answers from all instruments employed in this exploratory study. Individual responses are summed and divided by eight to arrive at the TIS score. The single number TIS score is compatible with other scales selected for this exploratory study and enables statistical evaluation of the responses. Figure 34 shows the demographic data collected during the survey. The collected demographic data provided additional information about the population only. None of the demographic teams served as a control variable for this exploratory study.

Administration of the survey

The survey design supported the use of pen and paper. The product development team members invited to complete the survey did not participate in the survey development processes. Human resources team members supported the distribution and collection of the surveys at various locations. The surveys were delivered and collected in envelopes to protect participants' anonymity. The human resources representatives from the remote locations collected and scanned completed surveys before emailing them to the researcher leading this exploratory study. A master Excel file served as a repository for the raw data. The CSV file exported from the master Excel file aided the statistical data manipulation using JASP.

I. What year were you born?	_______________ (Please write the full year)
II. Gender:	○ Male ○ Female ○ Other ○ Prefer not to answer
III. What is the highest level of school you have completed or the highest degree you have received?	○ Less than a high school diploma ○ High school diploma or equivalent (GED) ○ Some college but no degree ○ Associate degree ○Bachelor's degree ○ Graduate degree ○ Postgraduate degree ○ Other (specify)
IV. Which of the following best describes your role in the industry?	○ Upper Management ○ Middle Management ○ Junior Management ○ Administrative Staff ○ Researcher ○ Other ○ Trained Professional ○ Skilled Laborer ○ Consultant ○ Support Staff ○ Student
V. Are you married now?	○ Yes ○ No
VI. In what year did you first come to work for this organization? (for example, if you started in 2003 you would answer 2003)	_______________ (Please write the full year)
VII. Is your income the primary source of financial support for your immediate family?	○ Yes ○ No
VIII. How long have you been in your present job in this organization?	_______________ (Please write the number of years)
IX. In what year are you planning to retire?	_______________ (Please write the full year)

Figure 34 Demographic data collected during this study

Sample size

Generally, it is safe to say that a larger sample is preferable to a smaller one (Holmes Finch, 2020, p. 101). The literature offers several guidelines for a sufficient sample for conducting statistical tests like Exploratory Factor Analysis (EFA). Many studies recommend the ratio of the samples size to the number of observed indicators, including a 5:1 ratio (Gorsuch, 1997), 6:1 ratio (Cattell, 1966), and 10:1 ratio (R. H. Pearson & Mundfrom, 2010). The EFA results (presented in the subsequent sections of this chapter) indicate that the Team Interactions scale is a one-factor scale with a strong relationship between observed indicators and latent variables. For this situation, Holmes Finch (2020, p. 102) indicated that the researcher could obtain accurate results with smaller samples, sometimes as few as 20 to 30. The descriptive statistics presented in Table 10 are based on data from 54 valid surveys administered to various product development teams representing the light metal forming industry in the USA. In this exploratory study, the samples size to the number of observed indicators 6:1 and the demographic panel for the survey sample is presented in Figure 35.

Table 10 Descriptive statistics (N=54)

	Age	*Education*	*Role*	*Team tenure*
Valid	54	54	54	54
Missing	0	0	0	0
Mean	47.407	4.278	6.870	8.259
Std. Dev.	12.231	1.485	2.570	8.909
Minimum	19	2	2	1
Maximum	66	7	10	36

Figure 35 The demographic panel for the survey sample (N=54)

Exploratory Factor Analysis

One of the challenges in using the exploratory sequential design is the need for two different samples – the purposeful sample in the qualitative phase and a large sample of different participants in the quantitative phase (Creswell & Plano Clark, 2018). Creswell and Plano Clark (2018, p.89) indicated that ideally, both samples should be from the same population. This researcher achieved the recommended sample selection for this survey-development variant of the exploratory study of product development team members. Of over 20 product development professionals approached for this study, 16 agreed to the interview during the qualitative phase. Of 60 product development team members, 54 (or 90% of distributed surveys) completed the survey during the quantitative phase of the study (see Figure 35 for the demographic details).

Factor analysis is one of the methods for scale development (Costello & Osborne, 2005; Gorsuch, 1997; Holmes Finch, 2020; Spearman, 1904). Factor analysis is also one of the most widely used statistical procedures in the social sciences (Holmes Finch, 2020, p. 1). The aim of factor analysis is an analysis of survey participants' answers to identify a smaller number of more general factors that cluster answers to individual questions (de Vaus, 2002, p. 186). Exploratory factor analysis (EFA) examines all the pairwise relationships between individual items on a scale and seeks to extract latent factors from the measured variables (Costello & Osborne, 2005).

The five steps of factor analysis are (1) selection of variables for analysis, (2) extractions of the initial set of factors, (3) potential reduction of the number of items to reduce the number of factors, (4) extraction of a final set of factors using "rotation" and (5) construction of the scale used at this stage of the study. The decision on how many factors to retain depends, among other aspects, on the nature of the study. This researcher followed the mixed-methods approach to the exploratory study with an instrument creation. That is why the factors retained in the final scale have the highest “exploratory” potential for studying the team interactions during times of significant events like mergers, acquisitions, or joint ventures. The statistical computations package JASP supported the factors selection and scale validation (Gross-Sampson, 2019).

Table 11 Team Interactions Scale – Descriptive statistics (N=54)

	55: Team members acknowledge their weaknesses to one another.	59: Team members ask for help without hesitation.	62: Team members ask one another for input regarding their areas of responsibility.	65: Team members are quick to confront peers about problems in their respective areas of responsibility.	69: Team members question one another about their current approaches and methods.	82: Team members can comfortably discuss their personal lives with one another.	84: Team members consistently follow through on promises and commitments.	85: Team members offer unprovoked, constructive feedback to one another.
Valid	54	54	54	54	54	54	54	54
Missing	0	0	0	0	0	0	0	0
Mean	3.019	4.093	3.556	3.259	3.500	3.593	3.870	3.574
Std. Dev.	1.073	0.875	0.945	0.915	0.818	0.942	0.754	0.838
Skewness*	-0.324	-0.536	-0.236	0.219	-0.107	-0.208	-0.878	-0.043
Kurtosis**	-0.458	0.207	-0.164	-0.736	-0.428	-0.784	2.722	-0.496
Minimum	1	2	1	2	2	2	1	2
Maximum	5	6	5	5	5	5	5	5

N = 54

* Literature recommended values range for Skewness is between -1.000 and 1.000

** Kurtosis values of less than 3.000 indicate platykurtic probability distribution

After several rounds of EFA, the final version of the Team Interactions Scale contained eight items listed in Table 9. The subject experts supported the EFA process and approved the final version of the scale.

Table 11 lists the descriptive statistics for the final iteration of the Team Interactions Scale established for 54 valid survey results. The characteristics of data distribution used in this study are Skewness and Kurtosis. Data presented in Table 11 indicate that values for Skewness are well within a recommended range between -1.000 and 1.000 and permit this researcher to say that the distribution is only moderately skewed (Blumer, 1967, pp. 61–65; Freund & Williams, 1972, pp. 56–58). Kurtosis measures the "tailedness" of the probability distribution, and Kurtosis of less than 3.000 indicates normal and leptokurtic or broadening of the normal distribution peak (Kallner, 2018).

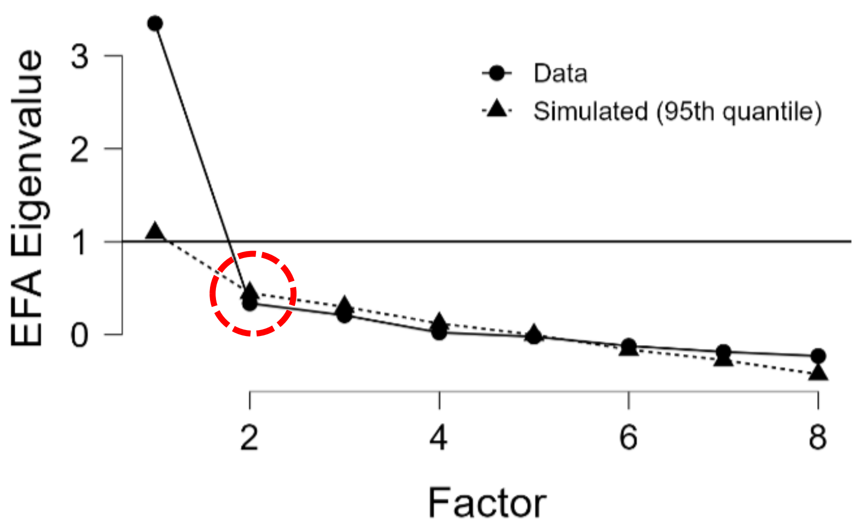


Figure 36 Team Interactions Scale – Scree plot

Researchers in social studies use three methods to decide how many factors to extract, including (1) eigenvalues higher than one, (2) scree plot, and (3) parallel analysis. Figure 36 shows that all three techniques favor a one-factor solution, with only one value greater than one. The scree plot (Cattell, 1966) is a popular approach for determining the optimal Exploratory Factor Analysis solution. The line plot with the eigenvalues on the *y* axis and the factor number on the *x* axis serves as the scree plot's base. The scree test involves examining the line plot of the eigenvalues and looking for the natural bend or elbow in the line representing the data where the slope of the curve flattens markedly (Osborne, 2014, p. 19). The scree plot for the Team Interactions scale data in Figure 36 clearly shows only one data point above the elbow (marked with the dashed line circle) and indicates that the Team Interactions Scale proposed in this exploratory study of the product development teams is a one-factor scale.

The scree plot generated using the statistical computations package JASP includes a line representing the parallel analysis (see the line for the simulated data in Figure 36). Parallel analysis generates random uncorrelated data and compares eigenvalues from the Exploratory Factor Analysis to eigenvalues from random data (Horn, 1965). Only factors with eigenvalues significantly above the mean (or preferably, the 95^{th} percentile) of random eigenvalues should remain (Osborne, 2014, p. 19). Unlike the scree plot test, the parallel analysis results are not subjective to the researcher's interpretation of the elbow's position. It is possible to compute and examine the 95^{th} percentile for all factors and indicate factors with eigenvalues exceeding random samples. The parallel analysis results in Figure 36 indicate only one factor with eigenvalues significantly above the 95^{th} percentile. The parallel analysis results and the scree plot for the Team Interactions Score proposed in this exploratory study are congruent, allowing for completing the following steps in the Exploratory Factor Analysis.

Table 12 Team Interactions Scale – Pearson's Correlations (N=54)

Variable		*55*	*59*	*62*	*65*	*69*	*82*	*84*
55	Pearson's r	—						
	p-value	—						
59	Pearson's r	0.541***	—					
	p-value	< .001	—					
62	Pearson's r	0.492***	0.416**	—				
	p-value	<.001	0.002	—				
65	Pearson's r	0.380**	0.394**	0.550***	—			
	p-value	0.005	0.003	< .001	—			
69	Pearson's r	0.312*	0.330*	0.464***	0.454***	—		
	p-value	0.022	0.015	< .001	<.001	—		
82	Pearson's r	0.250	0.276*	0.535***	0.344*	0.343*	—	
	p-value	0.068	0.044	< .001	0.011	0.011	—	
84	Pearson's r	0.400**	0.305*	0.395**	0.323*	0.382**	0.349**	—
	p-value	0.003	0.025	0.003	0.017	0.004	0.010	—
85	Pearson's r	0.492***	0.390**	0.543***	0.344*	0.427**	0.326*	0.628***
	p-value	<.001	0.004	< .001	0.011	0.001	0.016	< .001

* p < .05, ** p < .01, *** p < .001

The Pearson's Correlations presented in Table 12 indicate significant bivariate correlations. A brief scan of Table 12 shows that all variables included in the Team Interactions Scale significantly correlate with at least one other variable and Pearson's Correlation values greater than 0.3 (Warner, 2020). Additionally, this researcher completed the Bartlett test of sphericity designed to minimize the impact of the unique errors associated with individual indicators that are not accounted for by the factors (Holmes Finch, 2020, p. 98). The Null Hypothesis for the Bartlett test is that all correlations between the variables are zero. Table 13 shows that the p-value is close to zero (p < .001); thus, we can reject the Null

Hypothesis meaning that there are significant correlations within the data set collected from 54 surveys completed and returned by the product development practitioners.

Table 13 Team Interactions Scale – Bartlett's test (N=54)

X^2	*df*	*p*
141.108	28.000	< .001

According to common fit criteria (Marsh, Hau, & Wen, 2004), acceptable fit is achieved when TLI > .90 and RMSEA < .08, whereas excellent fit is achieved when TLI > .95 and RMSEA < .05. Further, lower BIC values indicate better model fit (Fabozzi, Focardi, Rachev, Arshanapalli, & Hoechstoetter, 2014, p. Appendix E). Table 14 provides the additional fit measures for the Team Interactions Scale, calculated using the JASP package.

Table 14 Team Interactions Scale – Additional fit indices (N=54)

RMSEA	*RMSEA 90% confidence*	*TLI*	*BIC*
0.024	0 – 0.124	0.988	-58.798

RMSEA – Root Mean Square Error of Approximation
TLI – Tucker-Lewis Index
BIC – Bayesian Information Criterion (or Schwarz Criterion)

The unidimensional reliability results for the Team Interactions Scale presented in Table 15 indicate that coefficients alpha and omega calculated using the survey data exceed the recommended values of 0.700. In summary, the eight items scale developed for this study meets the requirement for measuring the level of interactions among product development team members representing the light metal forming industry in the USA.

Table 15 Team Interactions Scale – Unidimensional Reliability (N=54)

Estimate	*McDonald's ω*	*Cronbach's α*
Point estimate	0.847	0.843
95% CI lower bound	0.785	0.768
95% CI upper bound	0.909	0.898

N = 54

Literature recommended McDonald's ω > 0.700

Literature recommended Cronbach's α > 0.700

The frequentist unidimensional reliability analysis allows the user to consistently test the scale's ability to measure a unidimensional construct. In other words, the analysis indicates the amount of error captured in the measurement. Table 16 reports the reliability estimates with an item dropped from the analysis.

Table 16 Frequentist Unidimensional Reliability Analysis (N=54)

Item	*If item dropped*		*Mean*	*S.D.*
	McDonald's ω	*Cronbach's α*		
55	0.830	0.826	3.019	1.073
59	0.833	0.829	4.093	0.875
62	0.807	0.807	3.556	0.945
65	0.829	0.826	3.259	0.915
69	0.833	0.829	3.500	0.818
82	0.840	0.837	3.593	0.942
84	0.832	0.828	3.870	0.754
85	0.822	0.817	3.574	0.838

The Cronbach's alpha and McDonald's omega reliability coefficients listed in Table 16 are lower than those reported in Table 15. This result indicates that the eight-item Team Interactions Score developed in this exploratory study is optimal.

Table 17 Team Interactions Scale – Kaiser-Meyer-Olkin Test (N=54)

	MSA
Overall MSA	0.836
55	0.845
59	0.857
62	0.817
65	0.862
69	0.910
82	0.824
84	0.802
85	0.805

N = 54
Literature recommended MSA > 0.800

The final test of the overall sampling adequacy for factor analysis is the Kaiser-Meyer-Olkin (KMO) Test measuring the proportion of variance among variables that might be common variance (Holmes Finch, 2020, p. 71; Kaiser, 1960). The higher the proportion, the more data is suitable for factor analysis. Kaiser (1960) suggested accepting MSA values greater than 0.5 as acceptable. Table 17 shows the KMO results for the Teams Interactions Scale. The Measure of Sampling Adequacy (MSA) values greater than 0.8 indicate adequate sampling. The MSA values for all items included in the scale are above 0.800, indicating high overall sampling adequacy achieved for this exploratory study of product development teams.

As mentioned before, an open-source software, JASP, supported calculations of the EFA parameters. The factors loading calculations included calculations of factor characteristics and additional fit indices. Factor loadings are the correlation coefficients for the variable and factor. They demonstrate the variance explained by the variable on that factor. Table 18 lists factor loadings for the final version of the Team Interactions Scale. All variables load on one factor, and all values are above the recommended value of at least 0.550 (Costello & Osborne, 2005).

Table 18 Team Interactions Scale – Factor Loading (N=54)

Variable	*Factor 1*	*Uniqueness*
62	0.781	0.391
85	0.719	0.483
55	0.644	0.585
84	0.622	0.613
65	0.620	0.615
69	0.600	0.640
59	0.586	0.657
82	0534	0.715

Note: Applied rotation method is oblimin

Table 18 also indicates the Oblique/Oblimin rotation allowing the researcher to limit how strongly the factors correlate. In other words, the rotation of the factor loading matrix helps find a more interpretable factor structure by simplifying the columns in the matrix (Costello & Osborne, 2005). The Team Interaction Scale is a one-factor scale with the undetectable difference between Orthogonal/Varimax and Oblique/Oblimin results calculated using the JASP software.

By combining theory, the KMO test, the additional fit indices RMSEA, TLI, and BIC with the examination of the scree plot, this researcher concluded that the Team Interactions Scale based on one factor is a valid instrument to complete the mixed-methods study of the product development team members’ behavior during externally induced events like joint venture, merging, acquisition, or technological change.

Correlations

A correlation between variables indicates that as one variable changes in value, the other variable tends to change in a specific direction (Harry et al., 2005). In statistics, correlation is a quantitative assessment that measures this tendency's direction and strength to vary together (Blumer, 1967; Freund & Williams, 1972). Table 19 includes Pearson’s Correlation coefficients for the variables established during the qualitative phase of this study and estimated with various scales during the quantitative phase of the same study. The correlations are among the average values calculated using data from each scale selected for this research.

All Pearson’s Correlation coefficients listed in Table 19 are more significant than zero and the accompanying statistical significance values *p* are smaller than 0.05. It is possible to conclude that all correlations established in this study are positive and statistically significant.

Table 19 Pearson's Correlation Matrix (N=54)

Variable		*1*	*2*	*3*	*4*
1. Affective Organizational Commitment	Pearson's r	—			
	p-value	—			
2. Perceived Person-Team Fit	Pearson's r	0.631***	—		
	p-value	< .001	—		
3. Team Interactions	Pearson's r	0.531***	0.566***	—	
	p-value	< .001	< .001	—	
4. Intent to Stay	Pearson's r	0.435**	0.334*	0.363**	—
	p-value	0.001	0.014	0.007	—

N=54

* p < .05, ** p < .01, *** p < .001

Positive coefficients indicate that when the value of one variable increases, the value of the other variable also tends to increase. The diagram of the relationship among the grounded theory variables presented in Figure 37 indicates that team interactions increase when the affective organizational commitment increases. This statement is congruent with the information derived from the interviews – the product development team members are more likely to consider staying with the company during the significant event if their opinion on the direction in which the new product development team should develop is received and acted upon by the team manager.

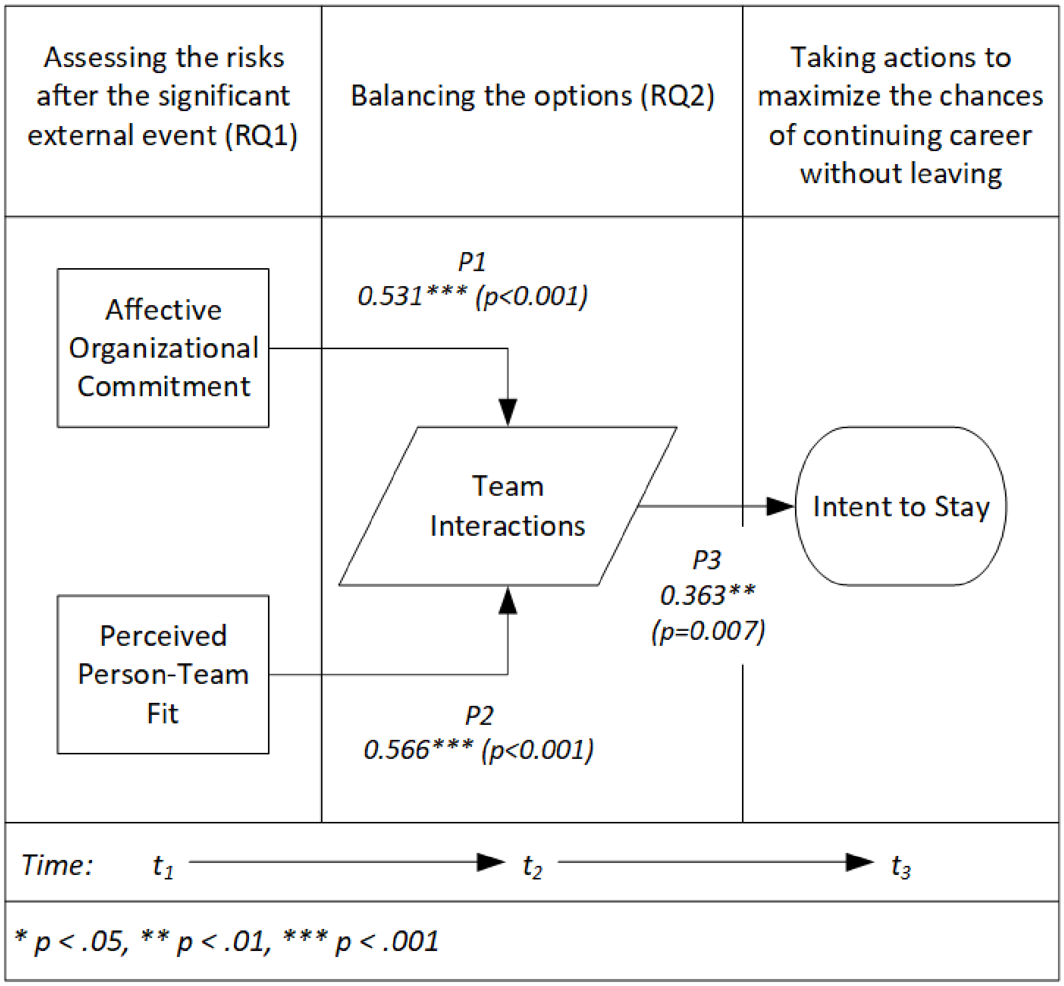


Figure 37 Diagram of the relationship among the grounded theory variables, including the propositions and Pearson's Correlation values

Another strong and positive correlation presented in Figure 37 is between the perceived person-team fit and the team interactions. This interaction reflects situations described by the product development professionals in which the product development team members assess the personal fit with the potential new product development team resulting from the significant event. As expected, the increase in team interactions could result from increased perceived person-team assessment by the product development team members. Finally, the intent to stay after the significant event potentially increases with the increase of the team interaction experienced during the significant event and expected after the significant event.

Creswell and Plano Clark (2018) recommended representing sequential integration through joint displays (p. 241). A joint display representing linked results for this exploratory sequential design with an instrument creation presented in Table 20 indicates how this researcher used the initial qualitative findings on the product development team members' behavior during a significant event like a joint venture or merger as an input to the quantitative testing of grounded variables in the group of product development team members representing the light metal forming industry in the USA. This researcher identified qualitative themes in the first column and then linked them to specific quantitative questions from scales used in this exploratory study.

Creswell and Plano Clark (2018) indicated that "the interpretation of the joint displays in an exploratory sequential design relates to how the quantitative feature and its subsequent results are improved through understanding the qualitative contextual sensitivity of participant experiences" (p. 242). In this mixed-methods study, the researcher interpreted how the qualitatively informed variables informed and gave contextual insight into the product development team members' experience. The last column of Table 20 provides the explicit statements as part of the results joint display, and the final chapter of this report provides interpretation.

Table 20 Joint display representing linked results for an exploratory sequential design with an instrument creation

Qualitative Subthemes (quotes from interviews)	*Quantitative Variables (examples from various scales)*	*p*	*Mixed methods interpretation*
Product development team members reported that they *like to stay put* while working on the *long-term projects*	*"For me, this is the best of similar organizations for which to work."*	< .001	***Organizational commitment***: Not only was it team development [QUAL] relevant, but it was also found to be statistically significant [QUAN] for product development team members representing the light metal forming industry in the USA
Product development team members indicated their affinity to work with people exhibiting similar *competencies, curiosity, and values*	*"I find that my values and the organization's values are very similar."*	< .001	***Person-Team Fit***: Not only was it team development [QUAL] relevant, but it was also found to be statistically significant [QUAN] for product development team members representing the light metal forming industry in the USA
Product development team members indicated that *job-related interactions* are as meaningful as the *intimate conversations*	*"Team members ask one another for input regarding their areas of responsibility."*	< .001	***Team Interactions***: Not only was it team development [QUAL] relevant, but it was also found to be statistically significant [QUAN] for product development team members representing the light metal forming industry in the USA
Product development team members are very likely to stay if they feel *empowered* and allowed a certain level of *self-determination*	*"I have significant autonomy in determining how I do my job, and I have significant influence over what happens in my department."*	< .015	***Intent to stay***: Not only was it team development [QUAL] relevant, but it was also found to be statistically significant [QUAN] for product development team members representing the light metal forming industry in the USA

Chapter 5
Discussion

Overview

The discussion of mixed-methods research results follows the design sequence and enables an open discussion of the results, potentially leading to new insights or breakthroughs (Creswell et al., 2006). It is the case with this exploratory study as well. This researcher carefully evaluated the qualitative and quantitative results, connected the findings with results published by other scholars, and proposed a set of new ideas potentially expanding Tuckman's 1965 model of team development. This researcher also indicated how the exploratory research results connect with the latest development in business analytics.

Organization of the Remainder of this Chapter

This chapter begins with the narrative summary of the results, starting with the problem statement, a review of the research questions, and the Team Interactions Scale review. The main section of this chapter is devoted to discussing the results in the larger context, going beyond the grounded data and information. The scope enlargement allowed for the formulation of new concepts like Team Interactions Score and the Dendritic Branching as a potential mechanism of team development between the significant events. A speculative CONE principle accompanies the new concepts introduced in this chapter. The final section of this chapter outlines the explanatory sequential design as one of several possible ways to continue the research on the late-stage and open-ended teams like the product development teams representing the light metal forming industry in the USA.

Summary of the study

In the context of the light metal forming industry in the USA discussed in Chapter 3, a product development team is a group of people tasked with carrying out various activities leading to the delivery of a new product to the market. The new products could be new to the market, company, or both. Most product development professionals interviewed during this exploratory study indicated that the new products delivered by their product development teams were new to the company. Only a few professionals mentioned products new to the market.

The above observation is congruent with the distribution of product development types reported by Cooper (2017). Cooper (2017) observed that the product development activities fall into one of the six categories presented in Figure 38. A close examination of Figure 38 indicates that over half of the product development activities are with low newness to the market, while about 20% of the product development activities could lead to a product new to the company while not new to the market. Only 10% percent of product development activities could lead to a breakthrough or products new to the world (p.27).

It is puzzling to note that Cooper, one of the most prolific authors in new product development (R. Cooper, 1988, 2017, 2019; R. Cooper et al., 1998; R. Cooper &

Kleinschmidt, 2007; R. Cooper & Sommer, 2018), seldom, if ever, mentioned the product development team members' role in bringing the new products to the market. On the other hand, some of the other authors representing the Product Development & Management Association (Belliveau et al., 2002; Githens, 2002; Kahn, 2005; Kahn et al., 2006; Leenders et al., 2002) also pay little attention to the dynamics of the product development team, especially during times of significant events. This exploratory study aimed to provide some information on the potential change to the product development team members' behavior during significant events like joint ventures and mergers and explore how these events could impact the delivery of the new products to the market.

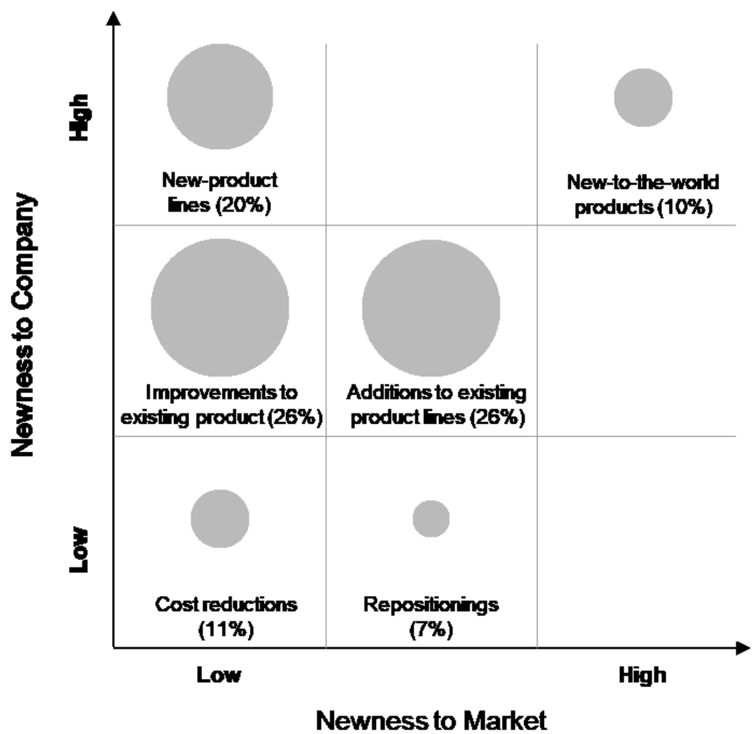


Figure 38 Reported distribution of product development types (R. Cooper, 2017)

Statement of the problem

Before beginning this exploratory study, the researcher completed an extensive literature review on the various aspects of the product development process. The literature gap mentioned above led this researcher to study team development in general, later focusing on the team development models. The detailed evaluation of Tuckman's model of group development (Tuckman, 1965) and its amended version (Tuckman & Jensen, 1977) provided some information about the final stage of team development – the adjourning. Like with the role of the product development team in the product development process, there is very little research published on the team members' behavior during the adjourning stage (Braaten, 1974; Keyton, 1993; Tuckman & Jensen, 1977; Wheelan & Hochberger, 1996). This researcher decided to explore the product development team members' behavior during adjourning stage of the team development and realized that locating product development teams entering the final stage of the team development and gaining access to these teams is challenging, if not impossible.

Fortunately for this researcher, the companies representing the light metal forming industry in the USA are very innovative. The innovation in the light metal forming industry focuses mainly on new alloys and materials (L. X. Bach et al., 2019; Li, Chen, Lang, & Xiao, 2021; Rakhmonov et al., 2021), new metal forming processes (Dewang, Panthi, & Hora, 2019; Groche & Resch, 2015; Raju, Ojha, & Harsha, 2008), and applications like power lines, high-rise buildings, window frames, consumer electronics, household appliances, aircraft components, spacecraft components, ships, trains, and cars (Ashkenazi, 2019; Bryan et al., 2018; Varshney & Kumar, 2020).

Additionally, since the early 1960s, the light metal industry has seen numerous vertical integrations and joint ventures creating adjourning-like conditions suitable for the exploratory analysis of teams during the adjourning-like conditions. Importantly, this researcher's vast professional network allowed for interviews with the product development professionals that potentially experienced adjourning-like conditions during significant events like joint ventures, mergers, acquisitions, and impactful technological changes.

Research questions

The following research questions guided this study:

1. What team member behavioral characteristics, derived from the interviews with product development professionals representing the light metal forming industry, change during Tuckman's adjourning phase? [QUAL]
2. If the derived characteristic behavior's change is present, how to determine the level of change? [QUAN]

The [QUAL]/[QUAN] nature of the research questions required a mixed-methods approach. This researcher selected mixed methods exploratory sequential design with the instrument creation outlined by Creswell and Plano Clark (2018). The qualitative phase of the research followed the Straussian approach to the grounded theory (Strauss & Corbin, 1997). This researcher coded the semi-structured interview with the product development professionals representing the light metal forming industry in the USA and established the monitoring team interactions as the main category of the proposed substantive theory of team interaction behavior during significant events supported by the tentative theoretical diagram of the relationship among the grounded theory variables (1) affective organizational commitment, (2) perceived person-team fit, (3) team interactions, and (4) intent to stay.

Team Interactions Scale

The *team interactions* were among the final categories emerging from the interviews with the product development professional representing the light metal forming industry. The team interactions category rests on *openness*, *trust*, *collaboration*, and *communication*.

In this exploratory study, selecting the items for the potential scale started during the analysis and coding of the first interview. This process of selecting items was congruent with Creswell and Plano Clark's (2018, p. 194) recommendation that the researchers must pay special attention to emergent quotes, codes, themes, and features that suggest a new variable and inform the selection, modification, or design of an instrument to measure that variable. Staying sensitive to the emerging themes helped this researcher create an instrument for testing the role of the intervening variable *"team interactions"* that surfaced late in the coding process. The proposed Team Interactions Scale not only reflects the main dimensions of the *team interactions* category arrived at during coding the interviews. This scale also echoes some of the between-the-line sub-dimensions detected by this researcher.

For example, components of item no. 82 – “Team members can comfortably discuss their personal lives with one another” do not appear in the body of the interview transcript. On the other hand, this researcher started each interview with a friendly exchange before the actual interview began. Similarly, after asking the final interview question, this researcher invited interviewees to ask him questions. These informal sections of the interview were not a part of the initial interview transcript. After transcribing these sections of the interviews, the new codes capturing the intimate nature of provided information emerged and served as a starting point for creating items no 55, 82, and 85.

The developed Team Interactions Scale was a subject of rigorous Exploratory Factor Analysis using data collected from five teams representing the light metal forming industry in the USA. None of the data used in the Exploratory Factor Analysis came from the product development professionals interviewed during the qualitative stage of this study. Table 21 summarizes the Team Interactions Scale's critical metrics and the literature recommended levels for these metrics. It is possible to conclude that all metrics are within the recommended range.

The final element of mixed methods exploratory sequential design with the instrument creation was a test of three propositions arising from the tentative theoretical diagram connecting the grounded variables. All correlations tested with three scales selected from the literature and the Team Interactions Scale created during this study are positive and statistically significant. The joint display of the explanatory sequential design in Table 20 found in Chapter 4 allows for a single-page overview of the entire study.

Table 21 Team Interactions Scale – Summary of study metrics (N=54)

Item	*Study metrics*	*Literature recommended metric*	*References*
Sample size			
Factor analysis minimum ratio of a sample size to factors	~ 6:1	5:1 6:1 10:1	Gorsuch, 1997 Cattell, 1966 R. H. Pearson & Mundfrom, 2010
Preliminary data checks			
Skewness	-0.743 and 0.183	Between -1.000 and 1.000	Blumer, 1967 Freund & Williams, 1972
Kurtosis	-0.845 and 0.108		
Exploratory Factor Analysis (EFA)			
Pearson's correlations between variables	All variables correlate with at least one other variable and value greater than 0.3	Greater then 0.300	Warner, 2020
Bartlett's test of sphericity	p < 0.001	p < 0.05	Holmes Finch, 2020
Kaiser-Meyer-Olkin (KMO)	0.856	Greater than 0.800	Holmes Finch, 2020 Kaiser, 1960
EFA Factor loading	0.523 and 0.849	Greater than 0.550	Costello & Osborne, 2005
Root Mean Square Error of Approximation (RMSEA)	0	Less than 0.05	Marsh, Hau, & Wen, 2004
Tucker-Lewis Index (TLI)	1.049	Greater than 0.95	Marsh, Hau, & Wen, 2004
Bayesian Information Criterion (BIC)	-62.05	Lower the better	Fabozzi et al.,2014
Unidimensional reliability			
Cronbach's alpha	0.842	Greater than 0.700	Cronbach, 1951
McDonald's omega	0.847	Greater than 0.700	Dunn et al., 2014

Implications and conclusions

This researcher explored the product development team members' behavior during the significant event expecting to find stories about people leaving their positions or teams due to joint ventures or acquisitions among companies representing the light metal forming industry. Instead, this researcher learned that the product development team members are likely to stay with the company in which they have an opportunity to interact with other practitioners while working on bringing new products to the market. Moreover, if the management grants them a certain level of self-determination and influence over the product development team's future, they are willing to stay with the company even if their perceived person-team fit is not very high.

Before further discussing this study's implications, it is important to recall some facts about Tuckman and Jensen's five stages model of team development (1975). In 1965, Tuckman published a meta-analysis of 50 papers, including psychoanalytic studies of therapy groups. Tuckman (1965) focused on interpersonal relationships and task activity deducted from the published reports and papers and hypothesized a four-stage model and coined the following names for each stage (1) *forming*, (2) *storming*, (3) *norming*, and (4) *performing*.

In 1977 Tuckman and Jensen were invited by *Group Organizational Studies* to publish an update to the model (Bonebright, 2010). Tuckman and Jensen (1977) acknowledged that the model of team development proposed by Tuckman (1965) was a conceptual statement and subject to further tests (p. 5). Tuckman and Jensen (1977) collected fifty-seven articles published between 1965 and 1976 and referenced the original paper by Tuckman published in 1965.

A significant outcome of the literature review by Tuckman and Jensen (1977) was a discovery of the final discernible and significant stage of group development – termination. Tuckman and Jensen (1977) leaned heavily on the study by Braaten (1974) that compiled most of the existing models of team development and demonstrated the termination phase's existence. Inclusion of the separation phase in the phase-based model of team development by Whittaker (1970) and the inclusion of termination as an integral part of the team development cycle by Yalom (1970) strengthened Tuckman and Jensen's conviction about a need to expand the original model (Tuckman & Jensen, 1977, p. 427).

In summary, Tuckman and Jensen (1977) included the fifth stage in the original model by Tuckman (1967) and called it *adjourning*. Interestingly enough, Tuckman and Jensen did not summarize expected team behavior characteristics during the adjourning phase of the team development neither in their publication on the amended model (Tuckman & Jensen, 1977, p. 427) nor in the subsequent publications on sequential group development (Tuckman, 2001; Tuckman & Jensen, 2011).

Over the past sixty years, other researchers proposed and discussed observable behaviors in team members entering the adjourning phase of team development (Bonebright, 2010; Garfield & Dennis, 2012; Hurt & Trombley, 2007; Jack & Brotheridge, 2008; D. J. King, 1997; Kozlowski et al., 1999; Mathieu, Kukenberger, & D'Innocenzo, 2014; Ravi & Sumathi, 2016; Rickards & Moger, 2000; Robbins & Judge, 2013; Sundstrom et al., 1990). Wheelan (2005, p.113) proposed ten team characteristics associated with the termination phase (see Table 22 for details). In the same table, the author indicted Wheelan's characteristics observed in this research and characteristics included in the proposed Theory of Monitoring Team Performance.

Table 22 Theoretical and observed characteristics associated with the adjourning phase of team development

Theoretical characteristic (Wheelan, 2005, p.113)	*Was it observed in this exploratory study?*	*Is it included in the substantive Theory of Monitoring Team Performance?*
Group members know that the group will be ending soon	Yes	Yes
The group's ability to manage conflict may begin to degenerate	No	No
Members may discuss ways to continue the group beyond its designated ending point	No	Yes
Work activity may increase or decrease abruptly	No	No
Feelings of solidarity among members may increase	Yes	No
Increased expressions of positive feelings among members may occur	No	No
Problematic issues may be avoided	No	Yes
Stress and anxiety among members is evident	Yes	Yes
Some members may become apathetic	No	No
Members discuss group achievements	Yes	Yes

The first characteristic, *"Group members know that the group will be ending soon,"* is unique in this exploratory study. While coding the interviews following Straussian guidelines on sensitivity to the information, this researcher coded several fragments of various interviews using the *"Legal aspects"* code. At the coding time, there was no clear idea of where the legal aspects of a significant event like a joint venture or merger should connect with the substantive theory. Straussian approach to completing the grounded theory study implies that the constant comparison and further grounding of observed themes never stop (Corbin & Strauss, 2015). The following fragment "haunted" this researcher for several months:

> *"I was running a plant for several years back, and I knew we were up for sale, and people were coming through the plant. I had no ability to tell people what was going on because it was going to cost me my job. So, I was not able to be particularly open." (P2)*

The above fragment fell in place only after proposing the substantive Theory of Monitoring Team Performance. Mergers are long-term projects initiated before the official announcement (Kubasek, Brennan, & Browne, 2003), and the team members could detect the change in the openness of other team members in the time leading to the announcement of the significant event (Frensch, 2007; Hogg & Terry, 2000; Keyton, 1993). In other words, the change in team interactions between the steady-state stage of team development and the significant event stage of team development could indicate the beginning of a different phase in team development.

Other product development professionals participating in this study also alluded to the fact that people *"could sense that something is coming"* and that not knowing what is coming *"increased team members' interactions on the emotional and professional levels."* Before tackling the implications of the above statements, we must address the temporal aspect of the significant event facing the product development team and the potential researcher's bias.

All the above information is grounded in interviews, survey results, and the relevant literature. The following sections could include information and results gathered by this researcher while completing other studies, including his 25 years of experience as a research scientist in metal forming specializing in product and process development. The information presented in the following sections is also a result of cooperation with the advisory committee members, that lent their expertise while correcting errors and mistakes. The above statement of admitting the potential for bias is a vital part of completing the grounded theory research while following the Straussian approach and must be included when extending the discussion of grounded results (Corbin & Strauss, 2015, pp. 46–52). The following sections address the temporal aspect of the significant event using data from this exploratory study and results published by other scholars.

Team Interactions Score

The following Wheelan's (2005) theoretical characteristic, "*Members may discuss ways to continue the group beyond its designated ending point,"* is an excellent opportunity to discuss time-related aspects of the significant event.

The element of time is critical for understanding teams; however, the temporal stability of the teams is seldom the focus of the published research. Some of the terms used to characterize the temporal aspects of the teams' development found in the literature are the age of the group (Wells & Pelz, 1966), the “group-age” (C. G. Smith, 1970), the group longevity (Katz, 1982), the team tenure (Brown & Eisenhardt, 1995), the team familiarity (Huckman et al., 2012), experience (Tesluk & Jacobs, 1998), and the temporal stability (Hollenbeck et al., 2012). The temporal unfolding that occurs during the evolution of a team is a central feature of developmental models. Product development teams, like other teams, require time to mature. They form, establish regulatory mechanisms, and evolve through a series of recognizable changes (Kozlowski et al., 1999). On the other hand, the groups’ continuous development *“is one of the most neglected critical issues in team research”* (Kozlowski et al., 1999).

Funk and Kulik (2010) developed six propositions modeling the relationship between late-stage group characteristics and performance in a study addressing the neglect mentioned above. These characteristics are (1) a long-shared history, (2) an indefinite endpoint, (3) a long member entry/exit history, and (4) a long “parent” organization relationship. Funk and Kulik (2010) pointed out that late-stage groups may need new, not yet developed instruments to effectively study team members' behavior. However, they did not provide any pointers on the potential design of an instrument applicable to the late-stage group performance analysis (Funk & Kulik, 2012).

This researcher studied the opinions of other scholars regarding the potential change in team members’ behavioral characteristics over time. An excellent review of the potential links between time and teams by Mathieu et al. (2014) stipulated that *“developmental theories of teams require researchers and practitioners to know what stage each of their* *teams has reached at any given point in time"* (p. 14). While it would greatly support the understanding of late-stage group development, it represents a daunting organizational challenge. On the other hand, some research shows that variables like person-organization fit change over time (Elfenbein & O'Reilly III, 2007, p. 115), while other variables, like organizational commitment, are somewhat stable over time (Mowday et al., 1979, p. 226). This researcher combined the indefinite endpoint idea of Funk and Kulik (2010), the time dependency of the person-organization fit of Elfenbein and O'Reilly III (2007), and the constancy of organizational commitment of Mowday et al. (1979) into an index of team interactions change.

The proposed index called Team Interactions Score *(TIS)* combines team member's fit with the organization and the level of team member's organizational commitment in the following equation:

$$TIS\ (t) = a(t) + b \tag{2}$$

Where *(a)* is the team member's fit with the organization and *(b)* the team member's organizational commitment. The definite integral of equation (2) between now and the time of the next significant event is:

$$\int_0^t TIS(t)dt = \int_0^t (a(t) + b)dt = -\frac{1}{2}at^2 + bt \tag{3}$$

With equation (3) in place, it is possible to calculate and chart the curves for extreme values of team members' fit with the organization *(a)* and team members' organizational commitment *(b)*. The following range of parameters is a base for curves presented in Figure 39:

$$a = \begin{cases} 1, for\ high\ fit \\ 0.5, for\ moderate\ fit \\ -0.5, for\ low\ fit \\ -1, for\ no\ fit \end{cases} \tag{4}$$

$$b = \begin{cases} 1, for\ high\ OC \\ 0.5, for\ moderate\ OC \\ -0.5, for\ low\ OC \\ -1, for\ no\ OC \end{cases} \tag{5}$$

The integration curves in Figure 39 represent a range of potential team development trajectories between two significant events. Two outermost curves are the integration boundaries for equation (3). The current version of the Team Interactions Score indicates the areas outside the outermost curves as uncharted. The horizontal line beginning at (0,0) indicates the unchanged level of values of team members' fit with the organization *(a)* and team members' organizational commitment *(b)* between two significant events. The area between the top outermost integration curve and the horizontal axis represents positive values of the Team Interaction Scores. In contrast, the area between the horizontal axis and the bottom outermost integration curve represents the negative values of the Team Interaction Scores.

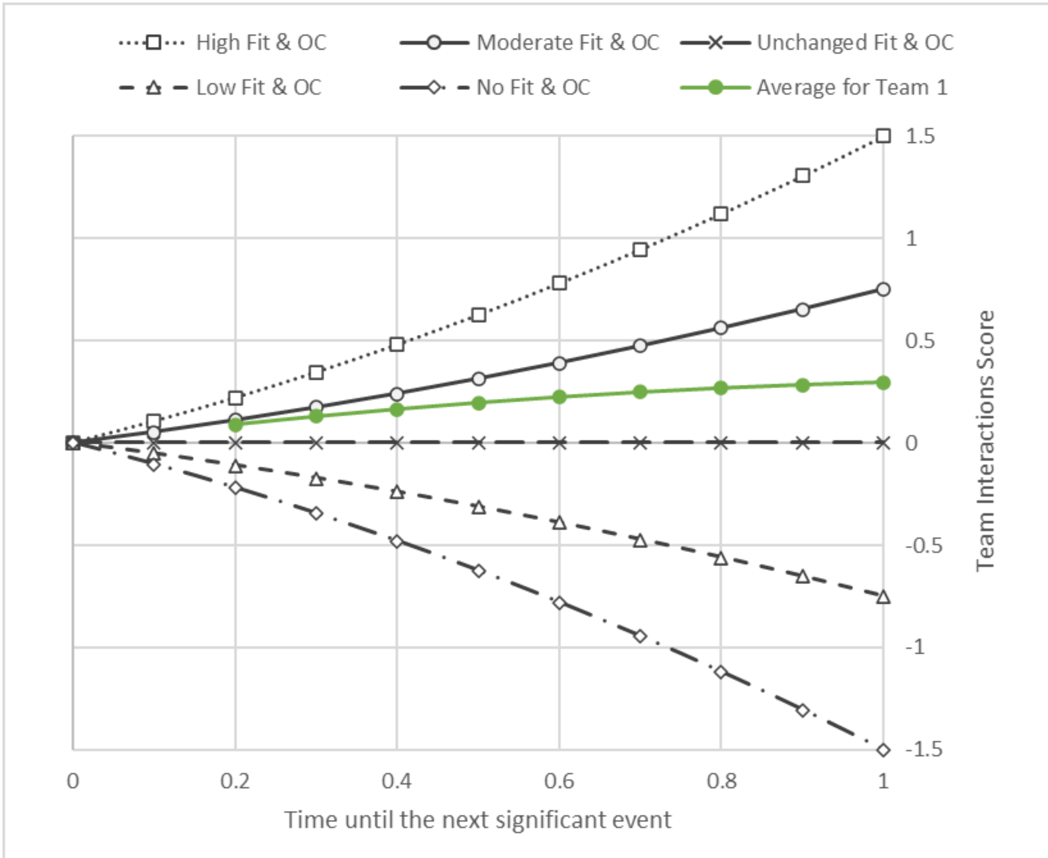


Figure 39 Integration curves representing various levels of Team Interactions Score

To understand the potential application of the Team Interactions Score, this researcher included a curve representing the average Team Interactions Score calculated for Team 1 participating in this exploratory study and representing the light metal forming industry in the USA. It is possible to observe that the line representing Team 1 is above the horizontal line and is asymptotically leveling off before the next potential significant event.

At the current Team Interactions Score development stage, it is impossible to determine the exact behavioral meaning of the curve representing Team 1 in Figure 39. This researcher speculated that such a curve could be indicative of a middle-stage team development where team members are still comfortable with the team and the organization before entering the late-stage team development characterized by increased isolation leading to a reduction in team interactions (Katz, 1982; Wells & Pelz, 1966). It is also possible that Team 1 is undertaking more prominent, more complex, and more variable activities requiring a high level of team interactions as described in the literature (Ancona & Caldwell, 1990; Bhuiyan, 2011; Brethauer, 2002; M. A. Cohen, Eliashberg, & Ho, 1996; R. Cooper & Kleinschmidt, 2007; Felekoglu et al., 2013; Leenders et al., 2002; McGrath et al., 2000; McGrath & Tschan, 2007; Sethi et al., 2001). The product development professionals invited to participate in this exploratory study also mentioned that long-term projects forced external team interactions with other internal teams and outside the organization. The results available in the literature and further support found in the coded interviews make the above speculation about the nature of Team 1 representing the light metal forming industry in the USA plausible and feasible for further investigation.

Dendritic Branching

This researcher observed another exciting characteristic of the proposed Team Interactions Score. This characteristic is a correlation between Team Interactions calculated using the scale established for this study and the Team Interactions Score calculated using the Affective Organizational Commitment scale (Mowday et al., 1979) and Perceived Person-

Team Fit scale (Lovelace & Rosen, 1996) selected from the literature. While the existence of the correlation is natural, the diminishing statistical significance of this correlation is an unexpected result. Figure 40 includes the integration curves representing various levels of the Team Interactions Score and the statistical significance isolines for potential correlation between the Team Interactions and the Team Interactions Score calculated in 0.100 increments until the next significant event. In other words, the cumulative charts like the chart in Figure 40 allow for speculation of the potential team development trajectory under the Substantive Theory of Monitoring Team performance introduced earlier in Chapter 4 of this manuscript.

For example, the product development trajectory for Team 1 in Figure 40 increases before asymptotically leveling around the 0.800 mark. However, the statistical significance isoline for the correlation between the Team Interactions and Team Interactions Score crosses into non statistically significant regions. Such a superposition of the curves could indicate that the team development trajectory for Team 1 could change sometime before the next significant event. These observations about the Team Interactions Score prompted this researcher to propose the idea of Dendritic Branching as a mechanism for the development of Late-Stage Teams. Dendritic Branching means that during the time between significant events, the team development trajectory will lay somewhere between the outer bands (or branches) of the integration cones, as illustrated with a red dashed line in Figure 41.

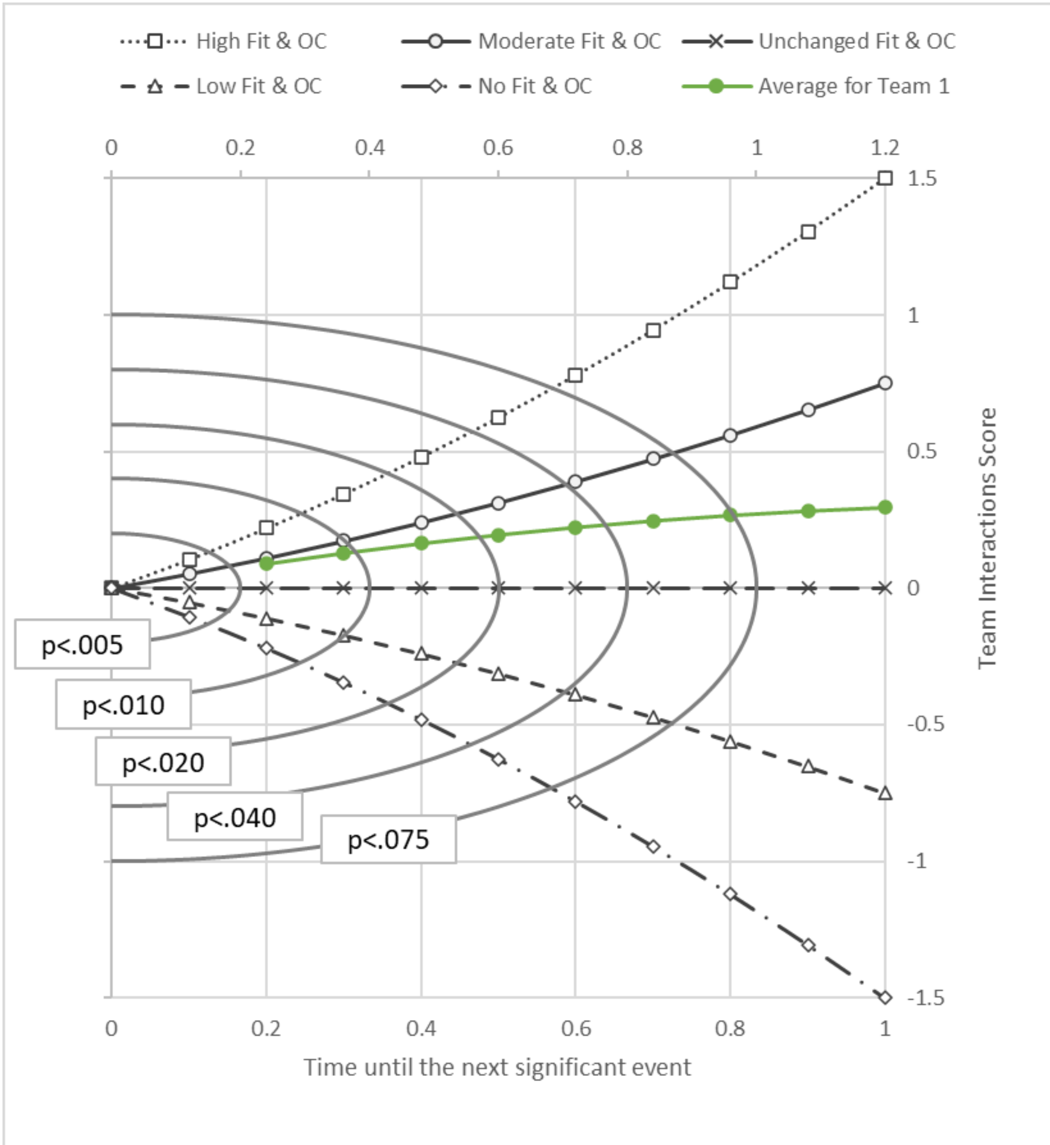


Figure 40 Integration curves representing various levels of Team Interactions Score with the statistical significance isolines

The Significant Event Discontinuity periods separate the regular team development periods. It is imaginable that the length of the discontinuities and regular team development periods are different for each significant event like a joint-venture or merger. More importantly, the starting point of branches eventually becoming the integration cone could begin at a different level representing a change in the Team Interactions Score between the significant events.

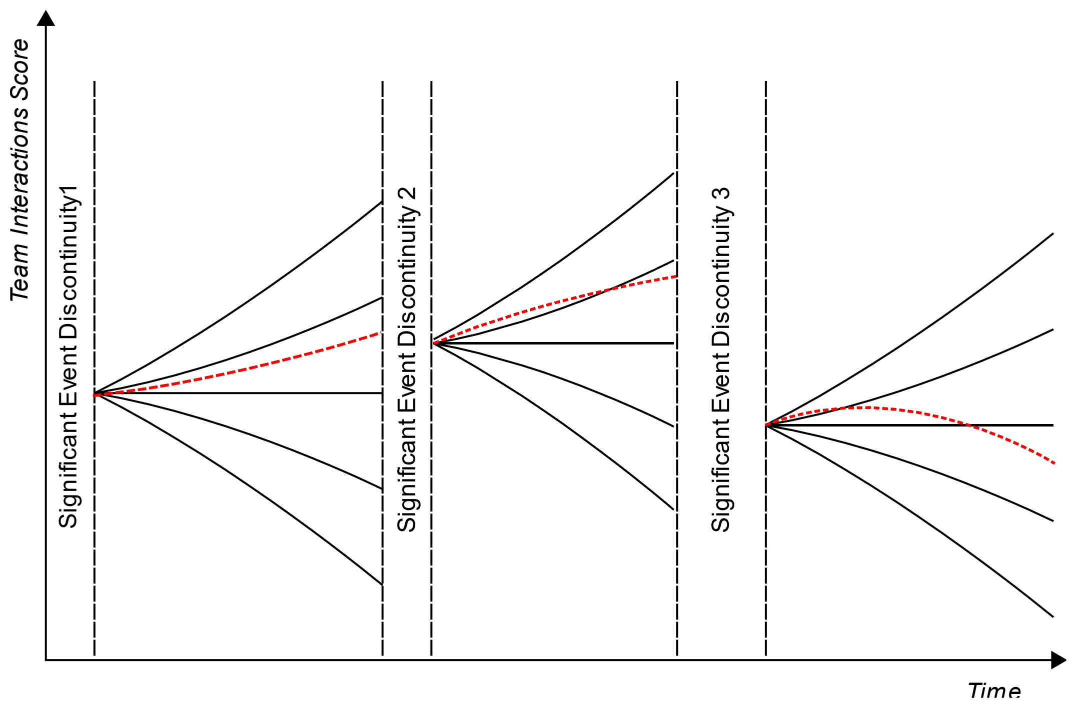


Figure 41 Integration cones of team development trajectories during the Dendritic Branching of Late-Stage Teams

Dendritic branching is a stage in the solidification of metals and alloys (Domkin, Hattel, & Thorborg, 2009; Goyanes, Det-Amornrat, Wang, Basit, & Gaisford, 2016) and the electrodeposition of metals and alloys (Jordan, 2011; Kohl, 2011). Dendritic branching is also very common in nature – trees grow by spreading branches and roots from the main trunk, neurons conduct the electric signals in mammals (Yoong, Pai, & Moore, 2019), and some crystals develop with a typical multi-branching form (Askeland, Fulay, & Wright, 2011). Yoong et al. (2019) studied the differentiation of rat cortical neurons and charted the individual neuron growth over 60 days, as presented in Figure 42.

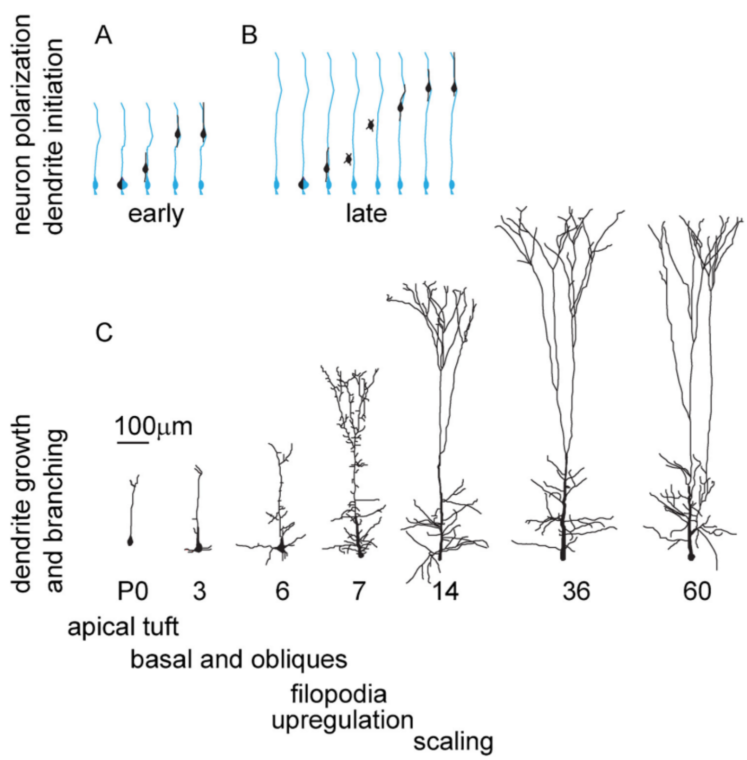


Figure 42 Dendritic growth and branching (Yoong et al., 2019)

While the images in Figure 41 and Figure 42 share some common characteristics, the mere existence of a phenomenon in nature does not make it an instant candidate to explain a phenomenon in another branch of science. In this summary, the dendritic branching serves as an example to aid the visualization of the proposed mechanism of the Late-Stage Teams' development. More research is necessary to address the applicability of such a mechanism to team development before formulating propositions for testing.

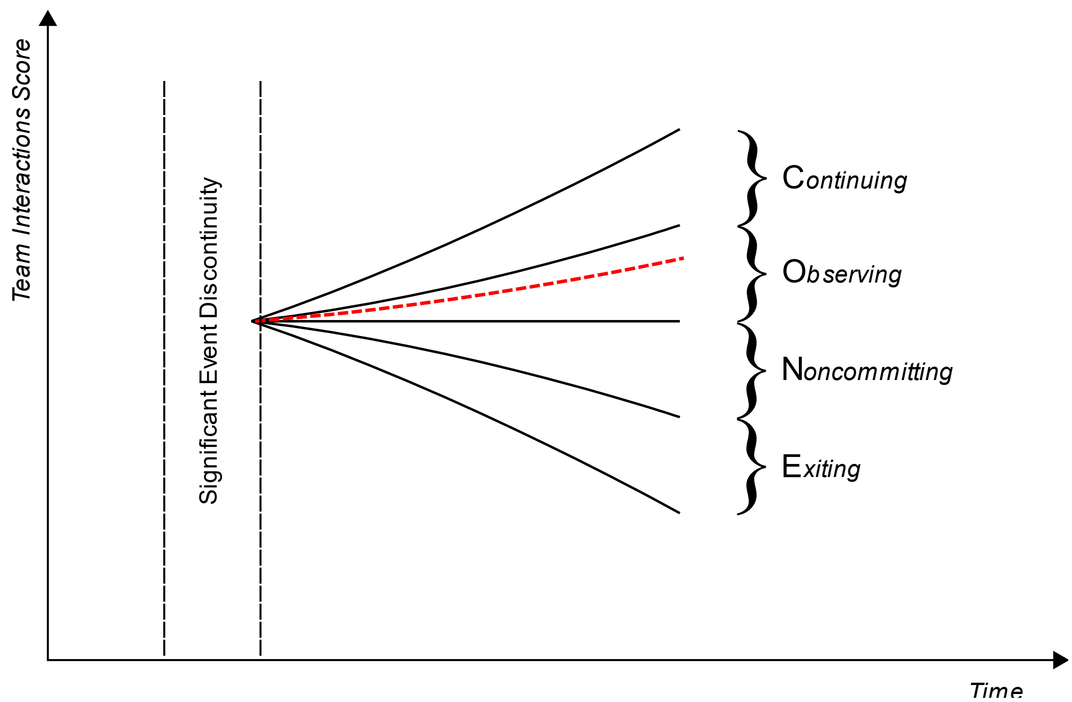


Figure 43 The CONE principle of the potential team development trajectories after the significant event

The CONE principle

The final element of this speculative section is an attempt to ground the dendritic growth and branching idea in the data derived from the interviews with the product development professionals representing the light metal forming industry in the USA. This researcher proposed a CONE principle to extend the dendritic growth and branching idea, as presented in Figure 43. This researcher named the regions between individual branches as continuing, observing, non-committing, and exiting.

As mentioned in this study, the product development team members like *“to stay put”* with the same organization after a significant event. It allows for the continuation of the long-term project with a possible high impact on the company (*Aluminum- Industry of the Future*, 2001; *Aluminum industry worldwide*, 2020; Egan, 2021). These observations prompted this researcher to name the top region *“continuing”* to retain its congruence with the information coded from the interviews. The second from the top region, *"observing,”* reflects the time it took some product development team members to decide between staying or leaving the company. One of the product development professionals stated that *“one of the team members had to be reminded that the time for deciding was up”* (P9).

The bottom region in Figure 43 is named *exiting*. Most study participants indicated that some people took early or planned retirement while some left right after the announcement. This researcher could not find any references to fit within the *non-committing* region. It does not mean that it does not exist; it only means that there was no information coded under this heading. More research is needed to explore this situation further.

The Model

It is essential to recall that the *"Monitoring Team Interactions"* is the core category of this exploratory study. The concept denotes the actions and interactions taken by product development professionals representing the light metal forming industry in the US (in conjunction with the product development team) to maximize the chances of continuing the career while minimizing the need for intercompany or intracompany mobility induced by external events like a merger, acquisition, joint venture or technological change.

The most rewarding part of completing this exploratory study was creating the model reflecting most of the grounded and theoretical results and presenting it in Figure 44. The left side of the model in Figure 44 represents the original Tuckman's model proposed in 1965. It includes only four stages (1) forming, (2) storming, (3) norming, and (4) performing. The adjourning stage was not included in the original model and appeared in 1977 after Tuckman and Jensen amended the original model. The Team Interactions Score drops from its initial level established during forming stage to the lowest level during the storming stage. The storming stage exhibits the highest level of conflict among the team members. After some time, the Team Interactions Score begins to rise, reflecting the beginning of positive team interactions due to roles division among the team members.

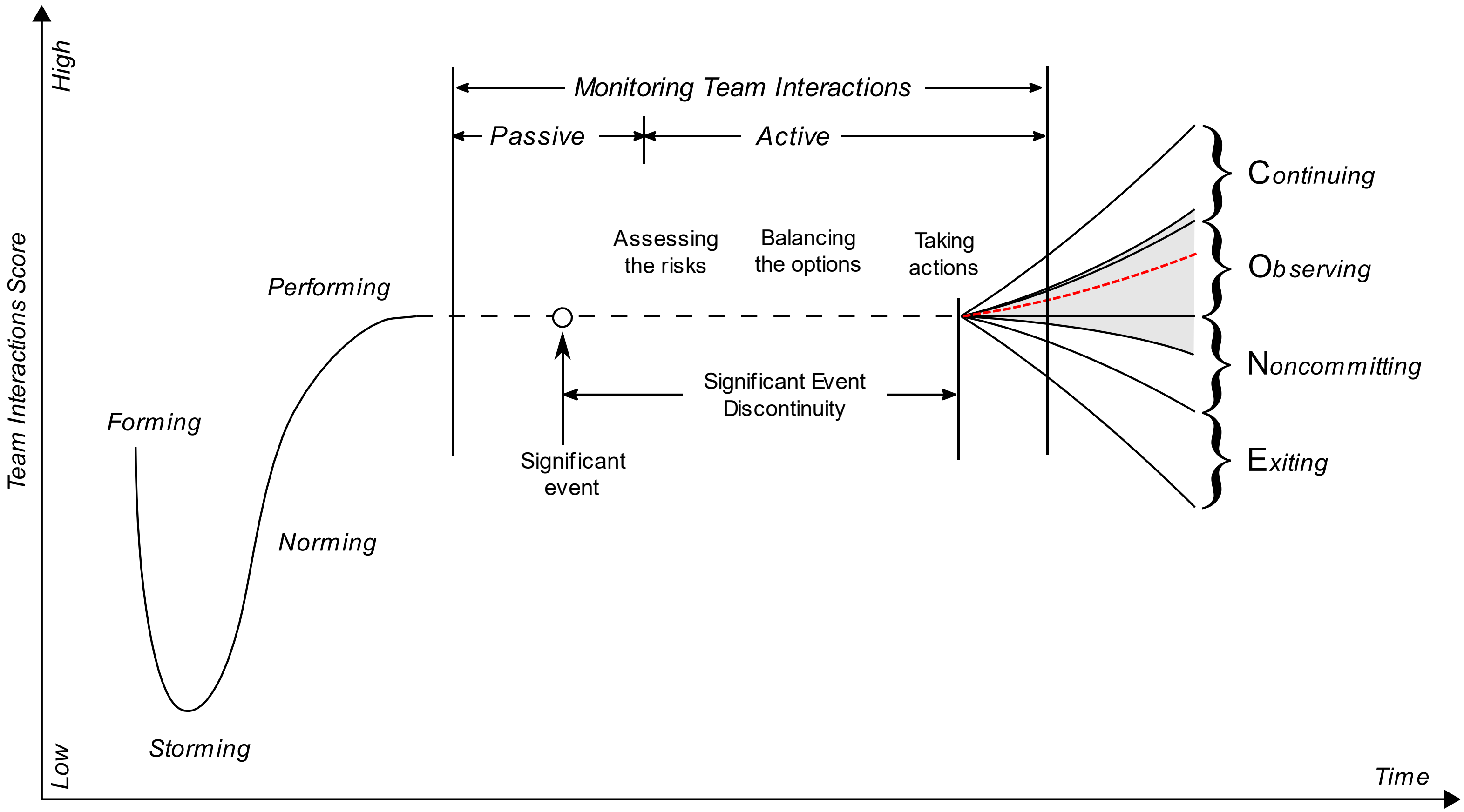


Figure 44 The tentative model of the Theory of Monitoring Team Interactions in a team facing the significant event discontinuity

The final stage of Tuckman's model, performing, begins when the team interactions level asymptotically reaches a stable level. Caple (1978) referred to this stage in team development as order, Wheelan and Hochberger (1996) called it simply work, and Rickards and Moger named it outperforming. Regardless of the naming convention, the scholars mentioned above did not discuss the steady-state performance stage of the team development in their published works available for review by this researcher.

This researcher proposed a substantive Theory of Monitoring Team Interactions as an extension of Tuckman's model. Monitoring Team Interactions consists of three main subprocesses: *"assessing the risks by interpreting the cues, "balancing the options for the desired outcome,"* and *"taking actions to control the risks."*

Assessing is defined as identifying and interpreting the cues leading to a definition of potential risks. The definition of the risk is perceptual rather than actual. The product development team members use communicational, informational, educational, and experience clues to assess the risks. They assess their fit with the product development team after a significant event like a merger or joint venture and their current level of vestment in the new company. They also assess the nonverbal clues like a change in what is communicated by the management. As described before, the public announcement of a significant event like a joint venture is gradual, and not all team members are informed about the upcoming change. This researcher called perceptual sensing *passive monitoring* and positioned it in front of the significant event discontinuity zone. With time, the team members are likely to become suspicious, thus entering the active monitoring zone encompassing the time before the announcement of the significant event, the significant event, and the significant event discontinuity, as presented in Figure 44. Many behavioral characteristics of the team members are affected by significant events like mergers (Frensch, 2007), potentially impacting the Team Interactions Score. The line representing the team development stage in Figure 44 is dashed and does not reflect the possible changes to the team development level during the significant event.

Balancing denotes considering all potential actions to continue a career and personal development with and without leaving their product development teams. The additional balancing includes the potential impact the team member will have on the future of the product team development and the possible change to the team interactions resulting from likely changes to the product development team composition. The personal aspect of the balancing includes relocation, increase in travel, and change in the rewards.

Moods and emotions experienced by the team members during the significant event influence resulting job satisfaction among the team members (Weiss & Cropanzano, 1996). Brief and Weiss (2002) proposed a model called an Affective Events Theory, potentially explaining the links between employees' internal influences and reactions to the significant events occurring in the workplace. The Affective Event Theory proposes that positive and negative emotional incidents have a significant and lasting psychological impact on some team members' behavioral characteristics, including organizational commitment. The Affective Events Theory does not include actions taken by the team members during and after the significant event. In other words, the Affective Events Theory by Brief and Weiss (2002) covers only two initial stages of the substantive theory of Monitoring Team Interactions proposed by the author of this exploratory study.

"Taking actions to control risks" refers to the product development professionals' actions to achieve the desired outcome. The major actions-interactions taken by the product development professionals aim to reduce the risks and maximize the chances of continuing a career and limit the impact of the decision on the personal life. It is not just about staying or leaving the company. It is a multi-dimensional problem with several outcomes that product development team members face during significant and extrinsic events impacting their current and most likely future team.

The *assessing-balancing-taking actions* sequence is somewhat congruent with the famous *input-process-output* sequence proposed by McGrath (1984). The input-process-output sequence models how people interact and how that interaction impacts the interpersonal relationship pattern. The most commonality between both models is present in the last stage, *taking actions* vs. *output*. That commonality is called *impact* and describes how the actions and interactions of the team members constitute the *influence process* involving outcomes or consequences of the interactions for the participants, their interpersonal relationships, and their task performance (McGrath, 1984, p. 17).

The *impact* or *influence process* does not stop by announcing the completion of a significant task like a joint venture or merger. This researcher proposes that the active stage of Monitoring Team Interactions extends well beyond that announcement point and continues to influence the potential product development trajectory. It is not clear how far into the future the *influence* formed during the significant event will continue to impact the team development trajectory; however, it is reasonable to discuss the possible change to the team development during that period.

This researcher shares Schneider's view that *the people make the place* (1987). The Attraction-Selection-Attrition framework (Schneider, 1987) could serve as a backdrop for the CONE principle introduced earlier in this chapter. This researcher proposed a CONE principle to extend the dendritic growth and branching idea, as presented in Figure 43. The regions are named continuing, observing, non-committing, and exiting. The attraction to an organization states that *"people are differentially attracted to careers due to their interests and personality"* (Schneider, 1987, p. 441). This researcher postulates that the team members attracted to the company will have their development trajectory positioned somewhere within the continuing zone, while the trajectory for the team members requiring more time to decide will be within the observing range.

The opposite side of attraction is attrition. Schneider (1987) stated that *"people who do not fit an environment well tend to leave it."* By applying the previously used line of reasoning, this researcher proposes that people *thinking* that they do not fit may have their development trajectory in the non-committing region. At this stage of the research using the substantive theory of Monitoring Team Interaction, it is impossible to propose what type of team members could have the development trajectory in the exiting region. This researcher found out that some product development team members left the company either voluntarily or forcibly immediately after the announcement of the significant event. The product development professionals interviewed for this exploratory study of the product development teams representing the light metal forming industry in the USA did not indicate a continuous exodus of the product development team members beyond the significant event.

The dendritic branching process proposed as a potential mechanism of late-stage team development builds on some of the propositions by Funk and Kulik (2012). Specifically, the propositions related to organizational attention identified by Huckman (1990) as the organization's assistance and support. In other words, it stands to reason that greater organizational attention could positively impact the organizational commitment, which in turn, positively impacts the overall Team Interactions Score and keeps the team development trajectory in the general attraction zone divided into observing and continuing areas.

Figure 45 indicates some of the interactions among the substantive theory of Monitoring Team Interactions and applicable Organizational Behavior theories. The extent of selected Organizational Behavior theories and their position in Figure 45 is arbitrary and serves as an approximation of the interactions. This researcher understands that more Organizational Behavior theories and models related to the product development sequence and team interactions could enter this study. Conversely, the selected Organizational Behavior theories and models are most applicable from the grounded theory results' point of view. This researcher reviewed the codebook established during the qualitative strand of this exploratory study before selecting supporting models and theories.

The idea of monitoring team performance is not unique. In 2011, Burtscher et al. studied the interactions between team processes and team performance in teams administering the anesthesia before surgical procedures. Burtscher et al. (2011) used some of the input-process-output principles while investigating a specific team coordination behavior and team cognition. Their results extended the process-outcome relationship typical for teamwork research in health care models (Burtscher, Kolbe, Wacker, & Manser, 2011).

In another study, Fisher et al. (2007) emphasized the role of monitoring team interactions during space missions. Fisher et al. (2007) focused on communication as an indicator of team functioning. After completing the linguistic analysis, the authors developed a scheme characterizing the social dimensions of team interaction. In this research, the team success was a function of shared task-critical information and equal participation of all contributors (Fischer, McDonnell, & Orasanu, 2007).

In the two examples above, the researchers studied close-ended teams. This exploratory study focused on open-ended teams like product development teams. De Jong and Elfring (2010) studied a large group of tax consultants working together in 92 teams while investigating team monitoring as a mediator between intrateam trust and team performance (De Jong & Elfring, 2010). They proposed that team monitoring can make team members more aware of others' actions, timing, and performance. De Jong and Elfring's (2010) observations of the team monitoring the effect on the team members are like the observations made by this researcher while coding interviews fragments about the situations in which the team managers could not discuss the impending significant event details due to legal reasons.

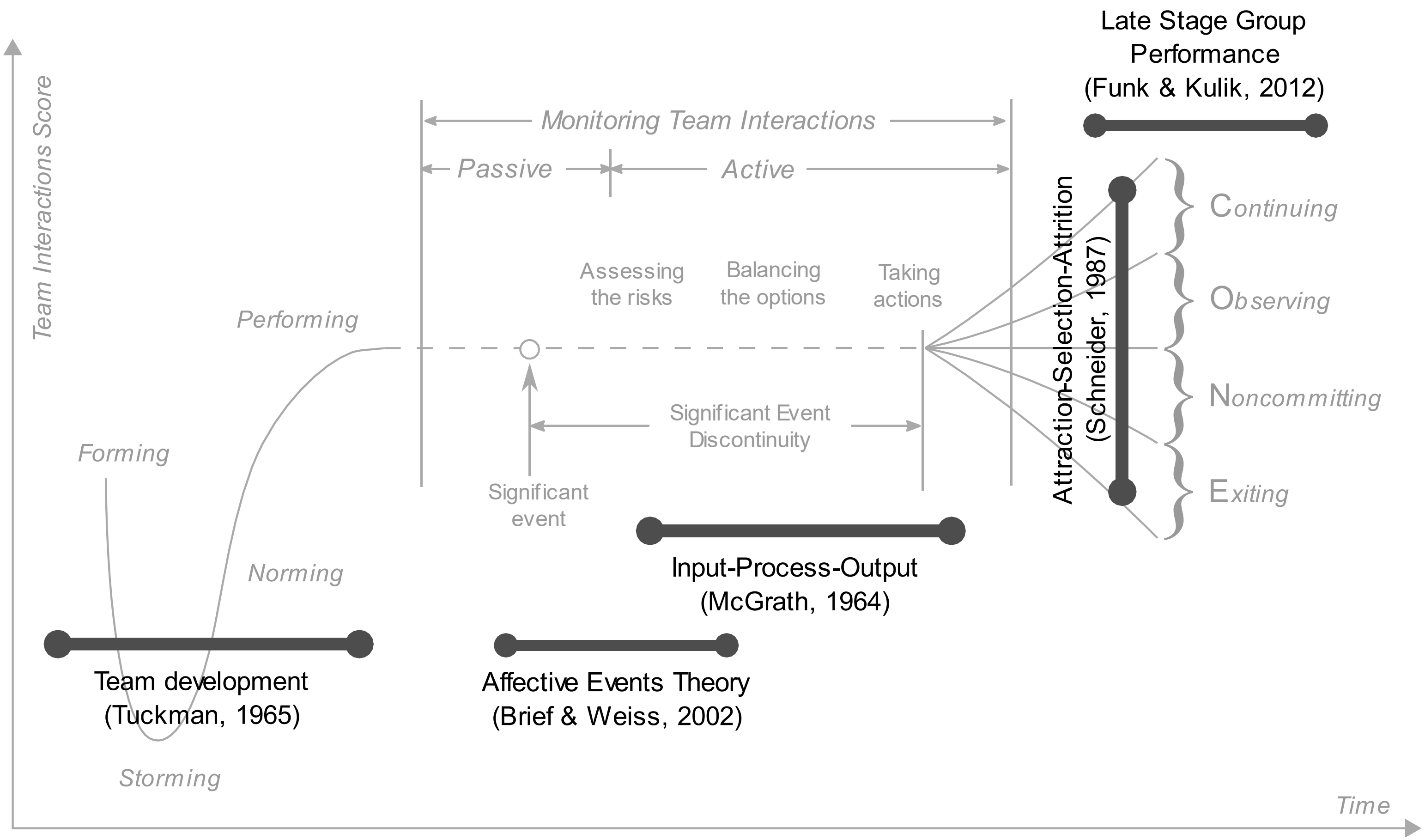


Figure 45 The coverage overlap between the Theory of Monitoring Team Interactions and the applicable OB theories

In the above literature examples, the researchers used an input-process-output principle to describe various aspects of team monitoring and its possible benefits. It is essential to note the applicability of the team monitoring to the study of close-ended teams like the anesthesiology teams and open-ended teams like the product development teams. This researcher believes that the proposed substantive theory of Monitoring Team Interactions fits the already available research on team monitoring.

The proposed theory can extend the team monitoring into the study of the late-stage and open-ended teams like the product or process development teams. Moreover, the proposed theory answers the call by Marks et al. (2001) for more research on temporally based frameworks for team processes. For example, Figure 44 shows the initial team development trajectory, including one significant event enabling the team members to decide how to continue working (or not) with the team in several ways as described by the CONE principle. Funk and Kulik (2012) suggested that developed teams or late-stage teams are likely to continue along already established team development trajectories. Figure 46 outlines a possible extension of the Theory of Monitoring Team Interactions into Team Development Trajectory over time. This outline suggests that significant events impact Team Development Trajectory’s shape and direction. This suggestion is congruent with the principles of the Affective Events Theory by Brief and Weiss (2002) and extends the impact of the significant events from an individual to the team. Such a shift in the unit of analysis is an exciting future research perspective on the potential link between team development trajectory as proposed by the Theory of Monitoring Team Interactions and the significant event's nature (positive or negative).

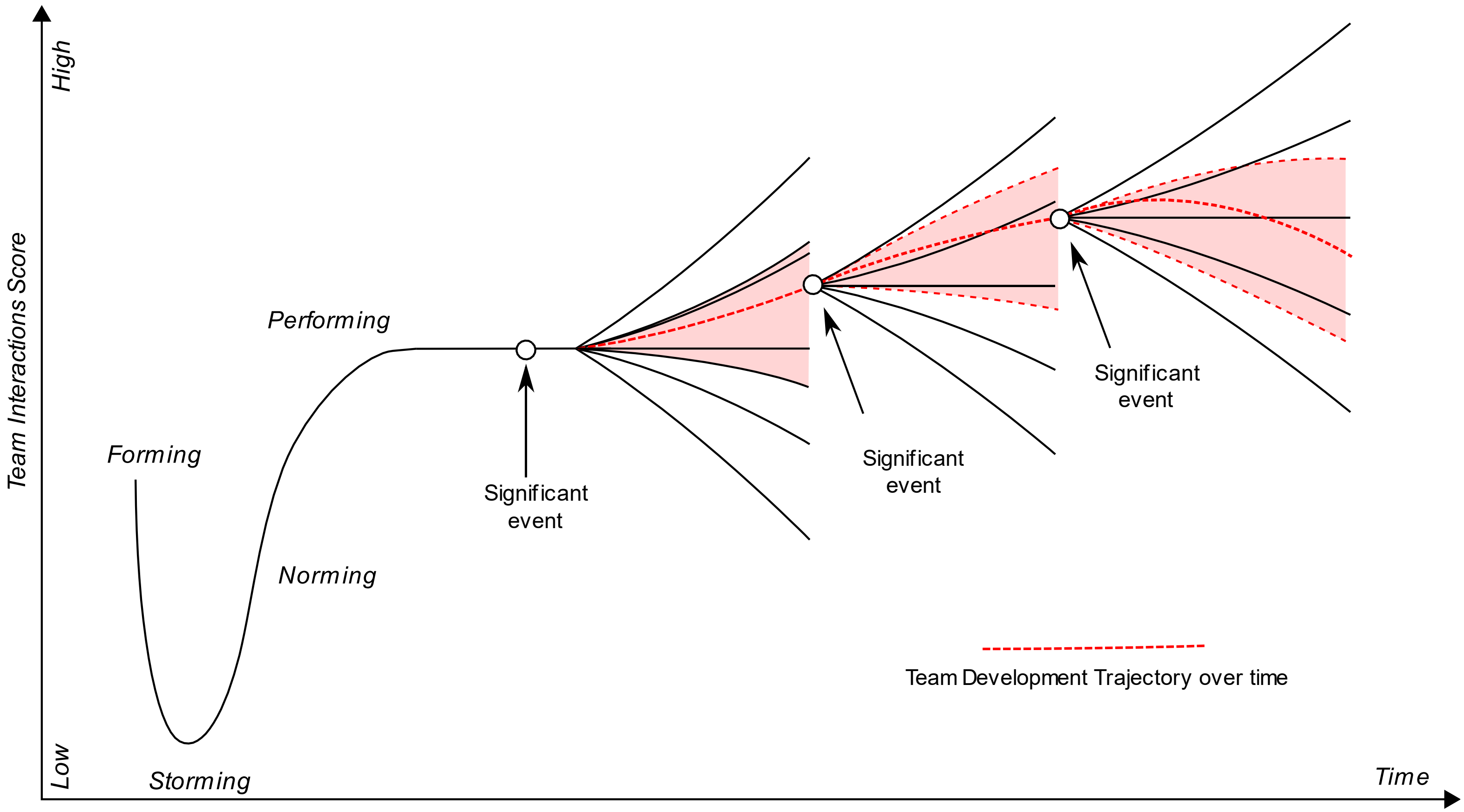


Figure 46 Extension of the Theory of Monitoring Team Interactions into Team Development Trajectory over time

Practical applications

This exploratory study focused on the product development team members' behavior during and after significant events like a joint venture or merger. It is only natural that the immediate practical application for the proposed ideas is in joint ventures, mergers and acquisitions, and significant technological change.

A joint venture is a general partnership for a limited time or purpose (Stuckey, 1983). Companies use the joint venture most often when they want to purchase knowledge or an already established manufacturing facility or need a rapid entry into a market (Hisrich, Peters, & Shepherd, 2013, p. 141). Mergers are a method of external growth instead of internal corporate expansion (Kubasek et al., 2003, p. 688). Divestiture of assets that no longer fit in with the parent company is one of the merger's hallmarks. Frensch (2007), in his excellent study of the social side of mergers and acquisitions, stated that:

> *"Mergers and acquisitions often fail to generate the expected value. One of the main reasons for such failures is a lack of cooperation among employees, which prevents the expected formation of synergies."*

The two most remarkable findings by Frensch are (1) integration measures are potent means to make employees cooperate after merger and acquisition, and (2) age does not matter when it comes to relationship formation, especially in an aging workforce (p. V)

The proposed Team Interactions Score complements Frensch's findings splendidly. The survey established in this exploratory study is easy to administer. Although designed for pen and paper administration, it could quickly become an online tool for improved reach and tally of the results. It stands to reason that the members of the executive teams created well in advance of significant events could administer the survey to establish the baseline, including the potential team development trajectories for teams in all involved companies. The joint venture team could use the Team Interactions Score to determine the percentage of people with high affective organizational commitment. If the percentage of team members with significant affective organizational commitment is low, the joint venture team could focus on the strategy that would make the new company an attractive workplace where people *want to* work instead of being *made to* work (Meyer, Paunonen, Gellatly, Goffin, & Jackson, 1989; H. J. Wang, Demerouti, Blanc, & Lu, 2018). Of course, it is just a speculative statement that would require additional research and, most likely, an experimental verification.

The proposed substantive theory of Monitoring Team Interactions and the accompanying survey could also support the product development team manager during the significant technological change. The significant technological change does not imply that the teams merge or adjourn. On the other hand, this change will most likely require some change to the current team's way of completing the tasks. For example, additive manufacturing, like 3D printing, dramatically changed the design and production of various parts (Ashkenazi, 2019; Balzerkiewitz & Stechert, 2020; Comai, 2018). It is possible to imagine a firm delivering forged cylinder pistons used in internal combustion engines. The cylinder pistons are not complex, and the forging of aluminum alloys is a well-established technology (Altan et al., 1983). The recent advent of electric vehicles significantly reduced the need for internal combustion engines. The forging company must face this paradigm shift and decide to continue with the forging while hoping for new business or embrace the change and bring new manufacturing technology like 3D printing. In both cases, the product development team members will face a significant challenge to their perceived fit with the company and the affective organizational commitment.

One exploratory study participant stated that the technological changes are either swift or not. The same participant also added that sensing or monitoring what is going on outside the company could somewhat reduce the impact of the technological change. In case of a long-term technological change, the product development team manager could use the surveys developed for this study and establish the potential team development trajectory for the team. After each organizational announcement, this manager could administer the same survey regarding the upcoming technological change. The semi-continuous monitoring of team members' behavioral changes could help the manager craft the message about the change and judge the impact of keeping the team members informed. Being open about the technological change before it happens is the opposite of being secretive about the joint venture. On the other hand, the Team Interactions Score could support management decisions in both situations, making the proposed instrument and accompanying ideas applicable beyond the USA's light metal forming industry

Limitations and future design

This study provided an initial test of the relationship between monitoring, team interactions, and the potential team development trajectories. It also supported the vital role of team interactions in the product development members' decision to stay with the company after a significant event like a joint venture or technological change. This researcher provided several "micro" comments about the speculative nature of some statements and indicated the need for more research on specific topics or features of newly introduced ideas like the Team Interactions Score, Dendritic Branching, or the CONE principle. This section is devoted to the "macro" limitations concerning the entire study.

The main methodological limitation is this researcher's expertise in conducting the mixed-methods exploratory sequential design while following the Straussian approach to completing the grounded theory study of the potential behavioral changes in the product development team member during significant events like joint ventures, mergers, or technological changes. According to Creswell and Plano Clark (2018), conducting any mixed methods study requires a balanced approach where methodological issues are not overshadowing the information emerging from data. This researcher kept the personal bias in check and created a code *"personal bias"* to capture situations where coding was biased either by previous experience or information acquired elsewhere. This *"personal bias"* code is most often present in memos created during this exploratory study.

As mentioned many times, this researcher followed the Straussian approach to completing the grounded theory study. The Straussian approach is more suitable for novice researchers than the Glaserian approach (Bryant & Charmaz, 2007; Castro et al., 2010). Keeping the research journal, writing memos, and capturing some ideas with diagrams or sketches kept this researcher within bounds established for mixed methods research (Strauss & Corbin, 1997).

From the quantitative point of view, this researcher recognized that using only correlations based on the responses from a medium-size group of respondents is a limiting factor. Furthermore, the respondents represent only one branch of manufacturing in the USA – light metal forming. This condition further constrains the possible applicability of the findings to other branches of manufacturing in the USA and abroad. Additionally, the Team Interactions Scale meets but does not exceed Exploratory Factor Analysis requirements for a social studies scale. While the previously mentioned quantitative limitations are in place, they are present because of the nature of the exploratory study into team members' behavior during and after the significant event. This researcher selected product development teams in the light metal forming industry because he currently leads several product development teams and is interested in understanding their nature and factor impacting their performance. This researcher believes that the encountered limitations' conundrum could dissolve by conducting the next-stage study described in the following section.

The explanatory sequential design is a "natural" mixed-methods design to complement and further develop ideas proposed while completing this exploratory sequential design. The explanatory sequential design (see Figure 47) begins with a quantitative strand and continues with a second qualitative strand to explain the quantitative results (Creswell & Plano Clark, 2018). The explanatory sequential design offers an opportunity to test the Team Interactions Scale in a more diverse group representing different manufacturing sectors like steel manufacturing or the oil and gas industry. A higher number of participants could enable the Confirmatory Factor Analysis of the Team Interactions Scale. One intriguing aspect of completing the explanatory study is using the quantitative data while designing questions for the qualitative strand. Such an approach expands the choice of qualitative methods beyond the grounded theory, including but not limited to phenomenological research or structured interview content analysis.

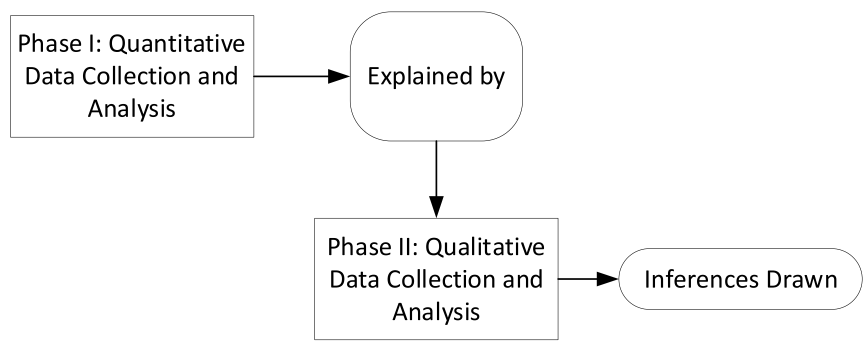


Figure 47 Explanatory sequential design

The explanatory sequential design would most likely provide additional insight into the substantial Theory of Monitoring Team Interactions and the accompanying ideas of the Team Interactions Score, Dendritic Branching, and the CONE principle. Specifically, these ideas' applicability to extending the stage model of team development in other than light metal forming industries. It would also be essential to involve a wider group of experts in the fields related to Organizational Behavior to capture the new information that escaped the exploratory lens.

Finally, the exploratory sequential design without employing the grounded theory during the qualitative strand would enable the future researcher to conduct an in-depth analysis or even a meta-analysis of the literature before formulating questions to ask the study participants during the qualitative strand. Such an extension of the basic exploratory sequential design would increase its exploratory power and propel the understanding of the role of Monitoring Team Interactions during the significant events experienced by the late-stage teams like the mature product development teams representing the light metal forming industry in the USA.

Concluding remarks

This exploratory study started by asking a simple question about the nature of the adjourning phase of the team development model introduced by Tuckman and Jensen in 1977. Since then, this researcher became familiar with some theories and models to explain team development dynamics, focusing on late-stage and open-ended teams. After exploring various aspects of the product development process like the role of Human Resources Management or the impact of team tenure on the product development team members, this researcher settled on exploring the potential behavioral changes observed in the product development team members during the adjourning-like conditions.

The selection of the mixed-methods exploratory sequential design allowed this researcher to become familiar with various qualitative and quantitative methods for studying social phenomena like the adjourning phase of the team development, and understanding the potential impact of the significant events on the team interactions allowed this researcher to formulate a substantial theory of Monitoring Team Interactions. Moreover, this researcher introduced the Team Interactions Score to plot the potential team development trajectories between two adjacent significant events. The description of the Dendritic Branching and the CONE principle complete this study.

This researcher believes that the proposed ideas are a natural bridge between the theoretical study aiming to extend Tuckman's team development model and people analytics, defined as using statistical insights from employee data to make people management decisions. One of the latest Harvard Business Review publications on Reinventing Human Resources (2019) includes a paper by Leonardi and Contractor explaining the nature and significance of business analytics. This paper indicated that around 70% of modern companies use some form of business analytics (Leonardi & Contractor, 2019). This researcher's greatest hope is that this exploratory study's results will someday nudge the use of business analytics above 70%.

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Appendix A: Informed Consent (Approved by IRB)

Florida Institute of Technology
High Tech with a Human Touch™

Informed Consent

Please read this consent document carefully before you decide to participate in this study. The researcher will answer any questions before you sign this form.

Study Title: A Mixed Methods Approach to Investigating Adjourning Phase Behavior in a Sample of the Product Development Teams in the Light Metal Forming Industry.

Purpose of the Study: The research involves developing and validating adjourning phase behavior assessment tools for helping companies such as yours increase the effectiveness of the product development teams during times of significant change.

Procedures: The interview sample population for this study includes managers or personnel in charge of the product development team in the light metal forming industry. The study will utilize semi-structured interviews lasting approximately 45 minutes. The study will use Microsoft Teams software, and only an audio stream will be recorded for transcribing and analysis.

Potential Risks of Participating: There is a very low probability and magnitude of physical or psychological harm associated with participation in this study. The risk level should not exceed the everyday life risks.

Potential Benefits of Participating: Successful verification of the proposed framework may stimulate more research on product development team performance during the final stage of the team development and may encourage creating the managerial tools in this vital area of study.

Confidentiality: Your identity will be kept confidential to the extent provided by law. Your information will be assigned a code number, instead of any personally identifying information. The list connecting your name to this number will be kept in a locked file on an encrypted and password-protected drive. When the study is completed and the data has been analyzed, the list will be destroyed.

Audio Recording: The audio recording will be assigned a code number, instead of any personally identifying information and will not be stored on the same encrypted and password-protected drive that the list connecting your name to this number. When the study is complete and the transcribed data has been analyzed, the recordings and transcripts will be destroyed. Your name will not be used in any report.

Voluntary participation: Your participation in this study is completely voluntary. There is no penalty for not participating. You may also refuse to answer any of the questions we ask you.

Right to withdraw from the study: You have the right to withdraw from the study at any time without consequence.

Whom to contact if you have questions about the study:
Pawel Kazanowski
Email: pkazanowski@my.fit.edu Phone: 616.295.7700

Whom to contact about your rights as a research participant in the study:
Dr. Jignya Patel, IRB Chairperson
150 West University Blvd.
Melbourne, FL 32901
Email: jpatel@fit.edu Phone: 321.674.7391

Agreement: I have read the procedure described above. I voluntarily agree to participate in the procedure, and I have received a copy of this description.

Participant: ______________________________________ Date: ________________

Principal Investigator: _________________________________ Date: ________________

Appendix B: IRB Certificate of Clearance for Human Participation Research

Florida Institute of Technology
Institutional Review Board

Notice of Exempt Review Status
Certificate of Clearance for Human Participants Research

Principal Investigator:	Pawel Kazanowski
Date:	May 7, 2021
IRB Number:	21-055
Study Title:	A Mixed Methods Approach to Investigating Adjourning Phase Behavior in a Sample of the Product Development Teams in the Light Metal Forming Industry.

Your research protocol was reviewed and approved by the IRB Chairperson. Per federal regulations, 45 CFR 46.101, your study has been determined to be minimal risk for human subjects and exempt from 45 CFR46 federal regulations. The Exempt determination is valid indefinitely. Substantive changes to the approved exempt research must be requested and approved prior to their initiation. Investigators may request proposed changes by submitting a Revision Request form found on the IRB website.

Acceptance of this study is based on your agreement to abide by the policies and procedures of Florida Institute of Technology's Human Research Protection Program (http://web2.fit.edu/crm/irb/) and does not replace any other approvals that may be required.

All data, which may include signed consent form documents, must be retained in a secure location for a minimum of three years (six if HIPAA applies) past the completion of this research. Any links to the identification of participants should be maintained on a password-protected computer if electronic information is used. Access to data is limited to authorized individuals listed as key study personnel.

The category for which exempt status has been determined for this protocol is as follows:

2. Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior so long as confidentiality is maintained.
   a. Information is recorded in such a manner that the subject cannot be identified, directly or through identifiers linked to the participant and/or
   b. Subject's responses, if know outside the research would not reasonably place the subject at risk of criminal or civil liability or be damaging to the subject's financial standing, employability, or reputation.

Appendix C: Initial Interview Protocol

Opening remarks:

- Hello, my name is Pawel Kazanowski, and I am a doctoral student at Florida Institute of Technology working on my dissertation. I am working on the project to understand the product development team's performance in a change or transition time. Today I would like to ask you a few questions about your perspective on the product development (or similar) team performance at your organization.
- Any information you provide will be strictly confidential. Nothing you say will be shared directly with your organization. I will only use this information to capture your perspective. Thank you in advance for your participation.
- Would it be all right if I record our conversation? That way I can engage in the conversation.
- I will be taking notes during this conversation. My notes will never be shared with anyone at your organization.

Beginning of the interview:

- Please tell me about your role in the organization
- What do you call product development teams in your organization? (This question is needed to use a proper term in the following questions)

- Do you find the product development team important to the organization?
- What makes the product development team important? (General product development team characteristics)
- Please tell me more about some of the team characteristics (or specific characteristics) you used above to describe the importance of the product development team? Are there any negative characteristics that you could include in your description?
- Do any of these characteristics or some of them change over time? If yes, please tell me how? If no, please tell me why?
- Are there any particular circumstances under which these characteristics could change dramatically?

Ending questions:

- Is there something that you might not have thought about before that occurred to you during this interview?
- Is there something else you think I should know to understand better the conditions under which the product development team behavior can change?
- Is there anything you would like to ask me?

Appendix D Revised Interview Protocol

Opening remarks:

- Hello, my name is Pawel Kazanowski, and I am a doctoral student at the Florida Institute of Technology working on my dissertation. In my research, I study how teams develop over time. Specifically, I am interested in the potential development of already established teams with expected goals like product development or process improvement. Specifically, I am looking for information on potential changes observed in the team members' behavior as time goes by.
- I am motivated by the fact that just because the team is performing at a given point in time is no assurance that it will continue to do so. The managers need guidelines on when to intervene, so the teams keep developing in the desired direction.
- Any information you provide will be strictly confidential. Nothing you say will be shared directly with your organization. I will only use this information to capture your perspective. Thank you in advance for your participation.
- Would it be all right if I record our conversation? That way I can engage in the conversation.
- I will be taking notes during this conversation. My notes will never be shared with anyone at your organization.

Beginning of the interview:

- Please tell me about your role in the organization
- Were you ever in charge of the product or process development team?
- How would you characterize the "perfect" product or process development team? Please include both desired and undesired characteristics.
- Do any of these characteristics or some of them change over time? If yes, please tell me how? If no, please tell me why?
- Let's talk about team development during the time of change. Which of those characteristics of the product or process development team would change if the team experienced a significant change to its surrounding environment (i.e., ownership change, significant reorganization, loss of a significant portion of a business, acquisition of a competitor, etc.)
- Have you been with the product or process development team during the time of a significant change – both imminent and long term? Have you observed any changes to the team's behavior? How about an individual team member's behavior? How about your behavior and feeling before, during, and after the time of change?

Ending questions:

- Is there something that you might not have thought about before that occurred to you during this interview?

- Is there something else you think I should know to understand better the conditions under which the product development team behavior can change?
- Is there anything you would like to ask me?

Appendix E: Methodological Consistency of a Grounded Theory Study

Corbin and Strauss (2018) proposed the following checkpoints for researchers and reviewers to evaluate the methodological consistency of a grounded theory study. The list should be used to capture any development and changes during the study.

No.	Checkpoint	Status	Date	Notes
1	What was the targeted sample population?			
2	How was the original sample selected?			
3	How did sampling proceed?			
4	What kinds of data were collected?			
5	Were there multiple sources of data and multiple comparative groups?			
6	Did data collection alternate with analysis?			
7	Were ethical considerations considered in both data collection and analysis?			
8	Were the concepts driving the data collection arrived at through analysis (based on theoretical sampling), or were concepts derived from the literature and established before the data were collected (not true theoretical sampling)?			
9	Was theoretical sampling used, and was there a description of how it proceeded?			
10	Did the researcher demonstrate sensitivity to the participants and the data?			
11	Is there evidence or examples of memos?			
12	At what point did data collection end or a discussion of saturation end?			
13	Is there a description of how coding proceeded, along with examples of theoretical sampling, concepts, categories, and relationship statements?			
14	What were some of the events, incidents, or actions (indicators) that pointed to some of these major categories?			

15	Is there a core category, and is there a description of how the core category was arrived at?	
16	Were there changes in design as the research went along based on findings?	
17	Did the researcher encounter any problems while doing the research?	
18	Is there any mention of a negative case, and how was that data handled?	
19	Are methodological decisions made clear so that the readers can judge their appropriateness for gathering data (theoretical sampling) and doing the analysis?	
20	Was the feedback on the findings from other professionals and participants?	
21	Were changes made in the theory based on this feedback?	
22	Did the researcher keep a research journal or notebook?	

Appendix F: Quality and Applicability of a Grounded Theory Study

Corbin and Strauss (2018) proposed the following checkpoints for researchers and reviewers to evaluate the quality and applicability of a grounded theory study. The list should be used to capture any development and changes during the study.

No.	Checkpoint	Status	Date	Notes
1	What is the core category, and how do the major categories relate to it?			
2	Is there a diagram depicting these relationships?			
3	Is the core category sufficiently broad so that it can be used to study other populations and similar situations beyond this setting?			
4	Are each of the categories developed in terms of their properties and dimensions to show depth, breadth, and variation?			
5	Is there descriptive data given under each category that brings the theory to life as that it provides understanding and can be used in a variety of situations?			
6	Has context been identified and integrated into the theory? Conditions and consequences should not be listed merely as background information in a separate section but woven into the actual analysis with explanations of how they impact and flow from action-interaction in the data. Describing context enables potential users of a theory to compare for fit the situations under which the theory was developed to situations to which they might want to apply it			
7	Has process been incorporated into the theory in the form of changes in action-interaction in relationship to changes in conditions?			
8	Is action-interaction matched to different situations, demonstrating how the theory might			

	vary under different conditions and therefore be applied to different situations?
9	How is saturation explained, and when and how was it determined that categories were saturated?
10	Do the findings resonate or fit with the experience of both the professionals for whom the research ended and the participants who took part in the study?
11	Can participants see themselves in the story even if not every detail applies to them?
12	Does it ring true with them?
13	Do professionals and participants react emotionally as well as professionally to the findings?
14	Are there gaps, or missing links, in the theory, leaving the reader confused and with a sense that something is missing?
15	Is there an account of extremes or negative cases?
16	Is variation build into the theory?
17	Are the findings presented creatively and innovatively?
18	Does the research say something new or put old ideas in new ways?
19	Do findings give insight into situations and provide knowledge that can be applied to develop policy, change practice, and add to the knowledge base of a profession?
20	Doe the theoretical findings seem significant, and to what extent? It is possible to complete a theory-generating study or any research investigation yet not produce significant findings.
21	Do the findings have the potential to become part of the discussion and ideas exchange among relevant social and professional groups?
22	Are the limitations of the study clearly spelled out?
23	Are the suggestions for practice, policy, teaching, and application of the research?

Appendix G Criteria for Choosing a Core Category

List of criteria to be applied to a category to help a researcher determine if a concept qualifies as a central category (Strauss 1987, p. 36):

No.	*Criteria*
1	The category must be sufficiently abstract to be used as the overarching explanatory concept tying all of the other categories together.
2	It must frequently appear in the data. It means that there are indicators within all or almost all cases that point to that concept.
3	It must be logical and consistent with the data. There should be no forcing.
4	It should be sufficiently abstract to be used to do further research leading to the development of general theory.
5	It should grow in-depth and explanatory powers as each of the other categories is related to it through statements of relationships.

Appendix H Organizational Commitment Questionnaire

Florida Institute of Technology
150 West University Boulevard, Melbourne, FL, 32901

Part One

	To what extent do you agree or disagree with each of the statements as far as your current organization is concerned? For each statement select one and only one response.	Strongly disagree	Disagree moderately	Slightly disagree	Neither disagree nor agree	Slightly Agree	Moderately agree	Strongly agree
1	I am willing to put in a great deal of effort beyond what is normally expected in order to help this organization be successful.	☐	☐	☐	☐	☐	☐	☐
2	I talk up this organization to my friends as a great organization to work for.	☐	☐	☐	☐	☐	☐	☐
3	I feel very little loyalty to this organization.	☐	☐	☐	☐	☐	☐	☐
4	I would accept almost any type of job assignment in order to keep working for this organization.	☐	☐	☐	☐	☐	☐	☐
5	I find that my values and the organization's values are very similar.	☐	☐	☐	☐	☐	☐	☐
6	I am proud to tell others that I am part of this organization.	☐	☐	☐	☐	☐	☐	☐
7	I could just as well be working for a different organization as long as the type of work was similar.	☐	☐	☐	☐	☐	☐	☐
8	This organization really inspires the very best in me in the way of job performance.	☐	☐	☐	☐	☐	☐	☐
9	It would take very little change in my present circumstances to cause me to leave this organization.	☐	☐	☐	☐	☐	☐	☐
10	I am glad that I chose this organization to work for over others I was considering at the time I joined.	☐	☐	☐	☐	☐	☐	☐
11	There's not too much to be gained by sticking with this organization indefinitely.	☐	☐	☐	☐	☐	☐	☐
12	Often. I find it difficult to agree with this organization's policies on important matters relating to its employees.	☐	☐	☐	☐	☐	☐	☐
13	I really care about the fate of this organization.	☐	☐	☐	☐	☐	☐	☐
14	For me, this is the best of similar organizations for which to work.	☐	☐	☐	☐	☐	☐	☐
15	Deciding to work for this organization was a definite mistake on my part.	☐	☐	☐	☐	☐	☐	☐

Appendix I Person-Organization Fit

Florida Institute of Technology
150 West University Boulevard, Melbourne, FL, 32901

Part Three

Please describe your current workplace using the following set of descriptions. For each description select one and only one response.

		Very poor fit	Poor fit	Slightly poor fit	Neither poor nor good fit	Slightly good fit	Good fit	Very good fit
30	Describe the fit between your values and the organization's values.	☐	☐	☐	☐	☐	☐	☐
31	Describe the fit between your ethics and the organization's ethics.	☐	☐	☐	☐	☐	☐	☐
32	Describe the fit between your goals and objectives and the organization's goals and objectives.	☐	☐	☐	☐	☐	☐	☐
33	Describe the fit between your skills and skills required by the organization.	☐	☐	☐	☐	☐	☐	☐
34	Describe the fit between your attitudes and attitudes expected by the organization.	☐	☐	☐	☐	☐	☐	☐
35	Describe the fit between your level of participation in extracurricular activities and the level of participation in extracurricular activities expected by the organization.	☐	☐	☐	☐	☐	☐	☐
36	Describe the fit between your level of interactions with co-workers and the level of interactions with co-workers expected by the organization.	☐	☐	☐	☐	☐	☐	☐
37	Describe the fit between your outside interests and the organization.	☐	☐	☐	☐	☐	☐	☐
38	Describe the fit between work-family balance and the organization.	☐	☐	☐	☐	☐	☐	☐
39	Describe the fit between your political views and the organization.	☐	☐	☐	☐	☐	☐	☐
40	Describe the fit between your religious views and the organization.	☐	☐	☐	☐	☐	☐	☐
41	Describe the fit between your and the organization definition of career success.	☐	☐	☐	☐	☐	☐	☐
42	Describe the fit between your personal dress preference and the dress preference required by your organization.	☐	☐	☐	☐	☐	☐	☐
43	Describe the fit between your personal style and the personal style desired by your organization.	☐	☐	☐	☐	☐	☐	☐

Appendix J Intention to Stay

Florida Institute of Technology
150 West University Boulevard, Melbourne, FL, 32901

Part Two

	To what extent do you agree or disagree with each of the statements as far as your current employment is concerned? For each statement select one and only one response.	Strongly disagree	Disagree moderately	Slightly disagree	Neither disagree nor agree	Slightly agree	Agree	Strongly agree
20	I will probably look for a new job in the next year.	☐	☐	☐	☐	☐	☐	☐
21	I often think about quitting.	☐	☐	☐	☐	☐	☐	☐
22	I have significant autonomy in determining how I do my job.	☐	☐	☐	☐	☐	☐	☐
23	I can decide on my own how to go about doing my work.	☐	☐	☐	☐	☐	☐	☐
24	I have considerable opportunity for independence and freedom in how I do my job.	☐	☐	☐	☐	☐	☐	☐
25	My impact on what happens in my department is large.	☐	☐	☐	☐	☐	☐	☐
26	I have a great deal of control over what happens in my department.	☐	☐	☐	☐	☐	☐	☐
27	I have significant influence over what happens in my department.	☐	☐	☐	☐	☐	☐	☐

	Please indicate how likely is the following statement as far as your current employment is concerned. Please select one and only one response.	Not at all likely	Not very much likely	Somewhat likely	Fairly likely	Quite likely	Very likely	Extremely likely
28	How likely is it that you could find a job with another employer with about the same pay and benefits you now have?	☐	☐	☐	☐	☐	☐	☐

Appendix K Principles for Measuring Teamwork Skills

Original Principles	*Emerging Principles*
1. For understanding teamwork, there is nothing more practical than a good theory (D. P. Baker & Salas, 1997)	1a: Full understanding of team performance requires behavioral, cognitive, and attitudinal-based measures. 1b: The development of team performance measures must be guided, in part, by theory and, in part, by empirical research.
2. What you see may not be what you get (D. P. Baker & Salas, 1997)	2a: Measures must capture the dynamic nature of teamwork. 2b: Measures must measurement tools must reflect the maturation process of a team. 2c: Measures must account for team member experience with a team.
3. There is no escaping observation (D. P. Baker & Salas, 1997)	3a: Team performance is not simply represented by what team members do. 3b: Observation is critical for measuring and providing feedback regarding team behavioral skills. 3c: Measures that assess team member shared mental models and interpositional knowledge must be developed and validated.
4. Applications, applications, applications (D. P. Baker & Salas, 1997)	4a: Team performance measures must be developed, implemented, and evaluated for a wide variety of teams in a wide variety of settings. 4b: Psychometric data must be collected on all new measures and team performance. 4c: Measures that assess team knowledge, attitude, and skill competencies must be developed, applied, and evaluated

5. Judges and measures must be reliable (D. P. Baker & Salas, 1997)	5a: Reliability studies must reflect characteristics of the measurement tool. 5b: Team performance expert observers must demonstrate high level of agreement (around90%) 5c: Team performance measures must demonstrate internal consistency. 5d: Measures must establish the reliability of team performance.
6. Validation for practice and theory (D. P. Baker & Salas, 1997)	6a: The content and construct validity of team performance measures must be determined. 6b: Valid team performance measure must contribute to the development of valid team performance theories. 6c: The criterion-related validity of team performance measure must be determined. 6d: Team performance measures must predict team outcomes. 6e: Team performance measures must look like they assess team performance.

Appendix L An example of Lencioni's Team Assessment

		Never	Rarely	Sometimes	Usually	Always
	Project name:					
	Date:					
	Respondent:					
1	Team members admit their mistakes.					
2	Team members are passionate and unguarded in their discussion of issues.					
3	Team members are quick to point out the contributions and achievements of others.					
4	Team meetings are interesting and compelling, not boring.					
5	During team meetings, the most difficult and important issues are discussed.					
6	Team members acknowledge their weaknesses to one another.					
7	Team members voice their opinions even at risk of causing disagreement.					
8	Team members point out one anothers unproductive behaviours.					
9	The team has a reputation for high preformance.					
10	Team members ask for help without hesitation.					
11	Team members leave meetings confident that everyone is committed to the decisions that we agreed on.					
12	During discussions, team members challenge one another about how they arrived at their conclusions and opinions.					
13	Team members ask one another for input regarding their areas of responsibility.					
14	When the team fails to achieve collective goals, each member take personal responsibility to improve the team's preformance.					
15	Team members willingly make sacrifices in their areas for the good of the team.					
16	Team members are quick to confront peers about problems in their respective areas of responsibility.					
17	Team members acknwledge and tap into one another's skills and expertise.					
18	Team members solicit one another's opinions during meetings.					
19	Team members end discussions with clear and specific resolutions and calls to					
20	Team members question one another about their current approaches and methods.					
21	The team ensures that poor preformances feel pressure and the expectation to improve.					
22	Team members willingly apologise to one another.					
23	Team members communicate unpopular opinions to the group.					
24	The team is clear about its direction and priorities.					
25	Team members are slow to seek credit for their own contributions.					
26	All members of the team hold the same high standards.					
27	When conflict occurs the team confronts and deals with the issue before moving on to another subject.					
28	The team is aligned around common objectives.					
29	The team consistently achieves its objectives.					
30	The team is decisive even when perfect information in not available.					
31	Team members value collective success more than individual achievement.					
32	Team members are unguarded and genuine with one another.					
33	Team members can comfortably dicuss their personal lives with one another.					
34	The team sticks to decisions.					
35	Team members consistently follow through on promises and commitments.					
36	Team members offer unprovoked, constructive feedback to one another.					
37	Team members place little importance on titles and status (a high score indicates that titles and status are NOT important to team members).					
38	Team members support group decisions even if they initially disagree.					