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Understanding Self-Managed Teams Using Biomimicking

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This is to certify that the doctoral dissertation by

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Walden University
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Abstract

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MBA, Liverpool University, 2013

BSc, Azad University, 1995

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

The potential high performance of self-managed teams can only materialize with implementing such teams properly and differently from traditional manager-led teams. This qualitative descriptive multiple case study presents biomimicking as a unique and untapped resource to achieve that potential by applying a biomimicking lens to help understand successful decision-making patterns for self-managed teams. The study population included team members of self-managed teams working in information technology companies in Toronto, Ontario, as the technology hub of Canada with a tendency to apply the latest approaches for teamwork performance and output. The conceptual framework of the study included teamwork, self-management, social choice, and social learning. Interviews conducted with members of 3 self-managed teams in the same company were the main source of data, manually coded, and analyzed to present how team members described their experience working in self-managed teams. The emerging themes of communications, core process, decisions, and experience were reviewed in conjunction with behaviors observed in social beings and intelligent swarms. The findings of the study demonstrated more success in achieving organizational goals with biomimicking behaviors. The results of the study can lead to the adoption of self-managed teams by more organizations. Improved chances of success of self-managed teams using biomimicking behaviors may result in higher organizational outputs and higher employee satisfaction and lead to positive social change by optimizing limited resources and promoting better work/life balance.

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Dedication

This study is dedicated to my wife, Nastaran, who supported me throughout the studies. Her encouragement was the main driver in all steps of this long journey, from the time I decided to switch between programs to many nights of studies. She the rock behind me in every step and the best friend in solving every problem.

I also dedicate this study to my daughters Yasaman and Rose. We were students for the past few years together. We had many long nights studying together as the family room took the form of a dorm room in a university, and enjoyed every bit of it.

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Chapter 1: Introduction to the Study

A self-managed team is one with members who receive minimum guidance and influence from higher levels of management in activities such as planning, organizing, and controlling (Vancea, 2015). Corporate leaders want to benefit from the potential advantages of self-managed teams. Many leaders establish self-managed teams to improve innovation, speed, and employee satisfaction (MacDonald, 2019). Leaders who lack strategies for setting up self-managed teams can create unresolved workplace issues and conflicts (Simard & Lapalme, 2019). Leaders must focus on organizational transformation to improve the success of self-managed teams; however, many leaders lack the strategies needed for the implementation of self-managed teams, and specifically, decision making as the essential difference between leader-managed teams and self-managed teams. The purpose of this multiple case study was to describe common decision-making strategies for self-managed teams as experienced by team members using behaviors exhibited in intelligent swarms.

The results of the multiple cases in this study indicated new ways for leaders to examine the encompassing implementation approaches for self-managed teams to avoid challenges with which team members from various teams will need to handle. An interdisciplinary view of self-management through the lens of biomimicking (applying behavior of social beings in nature) was the means for conducting this study. This approach can provide a framework that employers use to address the gap in the overall method of implementing self-managed teams with the use of swarm intelligence: suitable decision-making approaches and behaviors learned from other social beings.

Results from this qualitative descriptive multiple case study provide recommendations for employers to consider to solve the decision-making challenges they encounter when implementing self-managed teams. Employers can also discover optimized approaches in other areas of management. Solving self-managed team challenges will lead more employers to adopt these teams, improve employee satisfaction and work-life balance, and may lead to positive social changes in companies with self-managed teams more successfully.

This chapter includes the background of the study, the need for the study and its unique approach, and the problem statement, followed by general and specific areas of focus. The section on the study's purpose provides information on the design of the study and approach taken. The conceptual framework is included, along with the nature of the study, definitions, assumptions, scope, delimitations, and limitations. Finally, the chapter presents the significance of the research to practice and theory, followed by implications for social change.

Background of the Study

Leaders of organizations divide their resources into smaller business units or teams to better analyze the organization's mission, formulate actions, plan activities, and monitor progress toward organizational goals (Driskell, Salas, & Driskell, 2018). Team size depends on many factors, including organizational size and functions within the organization but on average, teams can have two members and up to hundreds. In this study, mid to large size companies with multiple teams of three to 10 members were considered. In any team design, there are various aspects of team design, such as tasks,

team dynamics, hierarchy, leadership, accountability, and authority. In a traditional team, a single leader or manager makes the decisions, assign tasks, and performs planning activities. Self-managed team members have full authority over team activities, including planning, organizing, and decision making (Vancea, 2015). Leaders of many organizations create self-managed teams to gain the expected benefits such as higher team performance and employee engagement; however, not all of them have successfully implemented self-managed teams (MacDonald, 2019).

Since the earliest references to self-organization in the 1960s (see Myers, 1968), corporate leaders have implemented different forms of self-managed teams with mostly positive but inconsistent results. Organizations with effective self-managed teams have higher performance levels, cost savings, innovation, customer satisfaction, commitment, and motivation (Magnusson, Brunetta, & Annosi, 2017). However, members of self-managed teams encounter different or similar but augmented challenges than members of traditional teams, such as dealing with authority, hierarchy, decision making, and groupthink. Leaders who understand the drawbacks of self-managed teams allow for recognition of potential challenges and set the right expectations for self-managed team members (Lee & Edmondson, 2017). Leaders who understand the challenges of self-managed teams provide team members with opportunities and tailored solutions rather than traditional approaches.

With an awareness of the benefits of self-managed teams, researchers have expanded their focus to include more complicated situations such as large, distributed teams (Davena et al., 2013). Despite the popularity and multiple applications of self-

managed teams, many leaders struggle to find the right implementation approaches for self-managed teams.

Corporate leaders must recognize the requirements and specific implementation needed for successful self-managed teams. How leaders organize and implement self-managed teams impacts the success or failure of team members (Renkema, Bondarouk, & Bos-Nehles, 2018). Leaders must organize and set up team design, employee interactions, conflict management, and communications differently for self-managed teams than for traditional teams. However, due to a gap in the literature and lack of standard in the industry, and improper planning/implementing on how to resolve these differences with an implementation approach, many organizational leaders achieve inconsistent or nonexistent results with self-managed teams.

As shown in the following examples, researchers have focused on specific aspects of the new approaches required for successful self-managed teams. Leaders must establish different teamwork rules to successfully implement self-managed teams (Moe, Dingsøyr, & Dybå, 2008). Other researchers have focused on movement to a flatter hierarchy (Stettina & Hörz, 2015). Managers need new leadership elements to support self-managed teams (Wilke, Lisa Rossum, & Wouter Dirk Have, 2018). Marshall, Brown, and Radford (2017) examined the level of trust leaders needed to allow successful implementation of self-managed teams. Although these studies presented how leaders can successfully implement self-managed teams, there is a dearth of research on the core decision-making differences between self-managed teams and traditional teams.

Members in self-managed teams must engage in decision-making processes as the traditional role of manager to make the decisions does not apply. Team members who are closer to the underlying elements of a situation make the decisions in self-managed teams (Moe et al., 2008). However, members of self-managed teams may struggle to make high-quality decisions due to issues such as groupthink and concerted control. In groupthink, a few vocal participants dominate the discussion and guide team members accordingly, diminishing the input from others and potentially causing missed opportunities (Lee, Chae, Uyen, Gim, & Kim, 2016). Members of self-managed teams may have increased problems with groupthink due to a lack of enforcement from external leaders (Neck & Manz, 1994). Organizational leaders could streamline the implementation of self-managed teams if they provided self-managed team members with tailored decision-making approaches.

Humans learn from nature and its inhabitants. Many inventors have been inspired by or simply mimicked these learnings, such as flying of birds used in designing airplanes and using the shape of dragonflies in building helicopters. Social beings (i.e., species that achieve goals through collaboration and cooperation) accomplish tasks without assigned leaders, the same core idea as self-managed teams. Social beings such as ants, bees, wolves, and fish have evolved over millions of years to work together to achieve their goals. The observed behavior of social beings was a component of my study to present more successful decision-making patterns.

Social beings have similar challenges as humans in self-managed teams. For example, social beings must find ways to improve the quality of their decisions (Taha,

Mustapha, & Chen, 2013), and they must optimize how they choose and schedule their tasks (Parvan, Nejad, & Alavi, 2014). Social beings use certain behaviors to overcome challenges in nature, such as how bees work together to decide the location of their new nest without anyone playing the role of a leader, or when birds follow simple rules to fly together by applying simple rules without an assigned dominant bird. These behaviors can indicate better ways to set up self-managed teams and implement successful decision-making processes among team members.

Recent study indicates the success of self-managed teams in the form of teams using Agile models in software development (see Serrador & Pinto, 2015). Agile models provide an iterative, evolutionary approach through the integration of customers and information technology (IT) team members functioning close to a self-managed team (Anwer, Aftab, Shah, & Waheed, 2017). Although not all Agile teams succeed or represent a full implementation of self-managed teams, they are useful as a starting point for the study of effective implementation of self-managed teams (Dingsøyr, Fægri, Dybå, Haugset, & Lindsjørn, 2016). Due to recent successful results from Agile teams in IT representing self-managed teams, and potential learning opportunity from biomimicking, research is necessary to understand whether biomimicking the intelligence of social beings can help self-managed team members develop better decision-making approaches in self-managed teams as practiced in IT.

Problem Statement

A traditional method of team management does not provide managers with an overarching model to meet the needs of self-managed teams. Compared to traditional

teams, successful high-performance self-managed teams require organizational transformation and leaders who accept employee involvement and maintain an openness in conflicts (Gupta, Melendez, Rosenthal, & Vrushabhendra, 2017). Self-managed teams are organized differently and require alternate implementation approaches than traditional teams, such as authorization of responsibilities, clear communication, flat hierarchy, operational freedom, and new coaching roles (Renkema et al., 2018). Successful self-managed teams may indicate high levels of organizational success; for example, nearly 80% of Fortune 1000 companies implement self-managed teams (MacDonald, 2019). Nonetheless, challenges such as groupthink, unaccepting work culture of employee decisions, and lack of agreed guided decision-making approaches augmented by the absence of managerial supervision indicate unsuccessful implementation of self-managed teams and the need for specific self-managed team implementation strategies (MacDonald, 2019). Corporate leaders in the fast-paced IT industry are increasingly implementing self-managed teams, especially for product development, more than employers in other industries.

Leaders of IT companies lack successful self-managed team implementation strategies, which causes unresolved workplace issues and conflicts (Simard & Lapalme, 2019). The site for my study was Toronto, Ontario, the hub of IT companies in Canada. When applied to similar problems such as logistics, networks, and optimization in problem solving, biomimicking behaviors have indicated effectiveness (Kennedy, Fecheyr-Lippens, Hsiung, Niewiarowski, & Kolodziej, 2015). Due to the similarity of self-managed teams and intelligent swarms, there is a need to assess whether

biomimicking is the right approach for self-managed team implementation and decision-making processes.

Purpose of the Study

The purpose of this qualitative descriptive multiple case study was to describe common decision-making strategies for self-managed teams as experienced by team members using behaviors exhibited in intelligent swarms in an IT company in Toronto, Ontario. Research from the study presents actual experiences of how members of self-managed teams exhibit effective social being group behaviors perfected for optimum outcomes through evolution. The participants were self-managed team members who have implemented technology-based self-managed team projects. Purposeful sampling - selecting information-rich and relevant cases (Patton, 2015) - enabled the selection of three self-managed teams from the same company. Each of the three teams in the study consisted of four to 10 members, and each team served as a different case as the context changed (e.g., underlying work, team members' experience, team dynamics under self-managed criteria). Data from the three teams were combined to produce the common findings across all cases.

Semi structured interviews were conducted with 14 team members. Each case included a team with those who function as self-managed team members (with or without prior similar experience), and each team member's knowledge of self-managed teams was a factor in the context of each case. Participants' experiences, along with a literature review of surveys on teamwork efficiency and self-managed teams, contributed to finding opportunities for corporate leaders to apply interdisciplinary knowledge of biomimicking

into management disciplines and address the gap between traditional versus required practices of self-managed teams.

Research Question

RQ: What are the common decision-making strategies for self-managed teams as experienced by team members using behaviors exhibited in intelligent swarms in an IT company in Toronto, Ontario?

Conceptual Framework

Organizational teamwork that encompasses a self-managed team approach was the conceptual framework of this study. The framework includes self-managed team implementation strategies such as decision making and flat hierarchy adaptation. In implementing self-managed teams, internal and external factors indicate the success or failure of self-managed team members. The central concept in the framework incorporates decision making and working within the organizational hierarchy. Aspects of this conceptual model were examined through the lens of biomimicking to compare successful patterns between self-managed teams and the behavior of social beings.

Various researchers, including Wilke et al. (2018) and Lee and Edmondson (2017), examined self-managed teams and workgroups. Myers (1968) and Meletiou (1970) originally described self-management theory as a case of every employee serving as a manager. Technological progress and the success of certain organizational structural approaches have caused the concept to progress quickly. The general knowledge and experience of self-management increased due to the concept of team wisdom as a significant indicator of success (Katzenbach & Smith, 2015), team member input, team,

and organizational levels. The gained knowledge and experience lead to more efficient self-managed teams (Magpili & Pazos, 2018) and the application of self-managed teams for rapid product development (Kaikkonen, Haapasalo, & Hänninen, 2018). Wilson's (1978) sociobiology served as the base for the study's biomimicking perspective. Sociobiology theory provides an explanation for social behavior through evolution. The focus of this study in relation to sociobiology is on social beings that have evolved to work together in groups and can perform functions not possible otherwise. This level of intelligence is known as swarm intelligence, meaning that individuals within the group work together and act as one higher entity exhibiting intelligence that they would not be able to achieve. The study presents how both intelligent swarms and members of self-managed teams work without leaders and provides a new perspective on the setup and operation of self-managed teams and behaviors learned through biomimicking.

Nature of the Study

Qualitative research is a method of research that produces findings not based on statistical procedures or other methods of quantification but through investigation of perspectives that subjects have and interpretation of their view of the world (Johnson, Buehring, Cassell, & Symon, 2007). A qualitative method is appropriate to explore how members of self-managed teams express their experiences of self-managed teamwork strategies, including the setup of their decision-making processes. The qualitative method is required since there are no indications of the need for quantitative research, such as assumptions of specific factors or the relationships between certain variables. As the

purpose of this study was to present an in-depth understanding of a complex situation, qualitative research was the best approach (Harrison, Birks, Franklin, & Mills, 2017).

The research design was a descriptive multiple case study, with each case providing a unique view of how team members describe the decision-making process. The case study design is suitable for the current research as the context is relevant, and the boundaries between the context and the situation are unclear. Investigators can use qualitative case studies to integrate complex survey data for a holistic understanding of the phenomenon (Baxter & Jack, 2008). Other methods, such as narrative and phenomenology, do not provide the similar potential. Scholars can use phenomenology to present participants' lived experiences in a phenomenon; however, the purpose of this study was to investigate the lived experiences of self-managed team members within the situation boundary of each team encapsulated in each case study over a period of team activity participation.

The research population included team members in organizations with self-managed teams. In this study, the sample was members of three self-managed teams with team sizes of four to 10 people; each team constituted a case for data analysis. Data collection was via semi structured interviews, with data analysis to entail categorizing the observations and explaining effective teamwork in self-managed teams. The proposition or issue of interest is the potential of higher successful experiences of self-managed team members through the application of certain social being behaviors.

Definitions

Agile model/method: Such a model or method is the overarching term for a set of software development methods in accordance with the values and principles stated in the Agile Manifesto (Alqudah & Razali, 2016).

Biomimicking: Individuals are biomimicking when they imitate the models, systems, and elements of nature to solve complex human problems (Vincent, Bogatyreva, Bogatyrev, Bowyer, & Pahl, 2006).

Groupthink: The mode of thinking that persons engage in when concurrence-seeking becomes so dominant in a cohesive ingroup that it tends to override realistic appraisal of alternative courses of action (Janis, 1971). Groupthink can lead team members to make faulty decisions because of group pressure due to a few members dominating the discussion and disregarding others' ideas (Derrick, 2018).

Intelligent swarm: An intelligent swarm is a system consisting of many individuals who coordinate activities using decentralized control and self-organization (Ismail, Desia, & Zuhri, 2015).

Self-managed team: A self-regulated, semiautonomous small group of employees who determine, plan, and manage day-to-day activities and duties under reduced or no supervision is known as a self-managed team (Parker, Holesgrove, & Pathak, 2015).

Teamwork: Teamwork is the process used by team members to work, collaborate, and achieve tasks (Driskell et al., 2018).

Assumptions

Assumptions are unverified states or functions of an entity of interest. Several assumptions were present in this research. The first assumption was that members of self-managed teams work as closely as possible to team-defining concepts. Without this assumption, the research would not show whether the success or failure of a project or release of a product indicated the self-managing nature of the team.

The second assumption was that team members understood how self-managed teams worked and understood the various methods applied, including the decision-making approach; I also assumed that they were able to perform these functions for at least one working cycle (project or product release). This assumption stemmed from the experiences of participants in various situations that provide opportunities for participants to present their true perspectives.

The third assumption was that members from each team would provide unique perspectives for each case. This assumption was based on each team member's background, experience, and overall personal frame of reference. The final assumption was that participants would be honest in answering interview questions. This assumption came from the willingness of leaders in the participating company to improve self-managing teams and the eagerness of team members to participate in this study.

Scope and Delimitations

Although leaders in any organization can benefit from high-performing self-managed teams, these teams are not suitable for all work settings (Cohen & Bailey, 2000). Giving authority to team members does not make the team a self-managed team,

as the process of establishing self-managed teams requires transformation and appropriate setup. The suitability of self-management and team transformation was out of scope for this study. The purpose of this study was to present data on setup processes, specifically decision-making processes, as the guiding tools for the authority that leaders grant to members of self-managed teams.

This study was limited to established organizational self-managed team structures. The goal of the study was to present the experiences of team members and show the successful implicit or explicit application of biomimicking behaviors by self-managed team members. The experiences of each team's members received consideration in separate cases. The cases are based in the same company to focus on the particular implementation of the self-managed team decision-making process. The selection of the geographical location and the IT industry was due to advancements in IT and the popularity of self-managed teams in the Toronto technology sector. Other locations and sectors were excluded.

The conceptual framework was limited to the decision-making processes and hierarchy implementation of self-managed teams. How the team fitted with the rest of the organization, inputs, and outputs to and from team members other than the decision-making processes, and how members worked within the team's implementation were not included. The personal decision-making frameworks and psychology of decision making were also out of scope for the research.

Case studies have a low capacity for generalization and transferability (Yin, 2003). The scope of this study included multiple cases to indicate the potential of

biomimicking behaviors in members of self-managing teams. Findings showed the potential application of biomimicking behaviors that indicate improved self-managed team implementation and decision-making processes. The research provided data for future studies on other aspects of the conceptual framework. The study also provided a seminal approach that researchers can use to explore the interdisciplinary fields of self-management and biomimicking.

Limitations

Limitations of the research included a lack of organizational understanding of self-managed teams and how the self-managed teams have been implemented in the sample organization compared to potential approaches taken in other companies. Another limitation was that the case study is inherently limited to the underlying cause, and generalization is not likely. The research was also limited in access to participants, as participants were engaged in new projects in different teams. Another limitation was the lack of previous research on the interdisciplinary view of self-managed teams and biomimicking behaviors. As the interviewer, I could have been biased when conducting interviews. Barriers include participants' openness to share their insights, the time and place of interviews, privacy, and confidentiality. The composition of the questionnaire and the interview session setups were considering these challenges.

Significance of the Study

Due to successful outcomes from self-managed teams, many leaders have attempted to establish such teams within their organizations; however, dealing with challenges with proper implementation has slowed the adoption of self-managed teams

(Lee & Paunova, 2017). Findings from this study could provide leaders with new biomimicking methods to resolve the challenges of establishing self-managed teams. The focus of this study was to present how members of self-managed teams make decisions as well as show how biomimicking behaviors could provide new and simple ways to implement decision-making rules for self-managed teams. The following sections present the significance of this research in management practice, theory, and the contribution to positive social change.

Significance to Practice

The significance of this study is in the practice of self-managed teams. The research findings provide information leaders could use to handle self-managed teams and address challenges that arise from traditional solutions to issues like groupthink and decision making. Currently, leaders try to apply traditional team approaches to self-managing teams; however, employers with an understanding of these challenges can better address or prevent issues (Simard & Lapalme, 2019). When members of self-managed teams improve their performance, organizational leaders can expect higher value and broader implementation of self-managed teams.

Significance to Theory

The originality of this study's contribution is the application of social beings' behaviors to self-managed team members. Behaviors observed in intelligent swarms and biomimicking behavior can be appropriately applied to interdisciplinary practical applications such as team decision making and general team management. Findings present a description of the application of learned behaviors of social beings through their

evolution in team management functions. This approach has not appeared in the existing literature on management.

Significance to Social Change

Improved chances of success using biomimicking behaviors to handle challenges of self-managed teams improve the teams' application in organizations. The successful usage of biomimicking to facilitate self-managed team implementation could inspire leaders of other organizations to establish self-managed teams. A better understanding of organizational outputs and higher performance at the organizational level may lead to positive social change. Ultimately, this study presents data that organizational leaders can use to optimize their resources and promote better work/life balance.

Summary and Transition

This chapter includes the context of this study and the need for specific approaches for self-managed teams. The purpose of this qualitative descriptive multiple case study was to present the implementation strategies of self-managed teams through the biomimicking lens. This chapter presented various studies that have addressed the differences between the organizational structures and settings needed for the success of self-managed teams; however, there is a dearth of research on general guiding approaches and decision-making processes as the main differentiating points between traditional and self-managed teams. This study has a biomimicking perspective that provides a general approach to implement self-managed teams, including decision-making processes. The results present a new way for leaders to implement and evaluate self-managing teams. Findings also indicate a new interdisciplinary field of self-management and

biomimicking. Chapter 2 will contain an overview of the literature on self-managed teams and the use of biomimicking to optimize problems in work selection and decision-making processes, as presented in accordance with the conceptual framework.

Chapter 2: Literature Review

Introduction

The success of self-managed teams depends on how leaders implement them. Successful implementation of self-managed teams requires organizational transformation strategies (Gupta et al., 2017). The transformation will need to be structural and cultural, to prepare people and organizational structures (like teams and rules of work) for the change. The strategies used by self-managed team members differ from those used by team members in traditional settings with a manager leading the team. Leaders must implement self-managed teams using different approaches. In self-managed teams, members have authority, communicate clearly, and participate actively (Renkema et al., 2018). Organizational leaders should implement specific strategies for self-managed teams to help team members overcome challenges such as groupthink (Neck & Manz, 1994) that limit some members from participating in team discussions and decision making.

There is an overall lack of literature on inclusive implementation strategies that employers can use to provide decision-making approaches for self-managed teams. Scholars previously used biomimicking behaviors to formulate new solutions for similar problems in logistics, network, and algorithm optimization. Kennedy et al. (2015) reflected on how biomimicking can be used as a sustainable source of innovation in various fields. Researchers who have studied self-managed teams have not focused on an inclusive implementation strategy and instead have focused on writing about general guidance or limited focus on specific problem areas like leadership, communication, and

structure (see Beersma, Greer, Dalenberg, & De Dreu, 2016; Lee & Paunova, 2017; Liff & Gustavson, 2016). This indicates a gap in the implementation of self-managed teams and presents the opportunity to evaluate and appraise new self-managed team implementation strategies.

Studying the behavior of nonhuman social beings presents a new approach to self-managed team implementation strategies. Tindale and Kameda (2017) recommended further research on the potential benefits of understanding group behavior between humans and social beings. Many species of social beings such as ants, bees, and birds work together on certain activities like finding a nest, fighting intruders, and finding food, without leaders and use simple concepts of swarm intelligence to solve problems they would be incapable of solving individually. It is possible to learn from species with social behaviors to improve of self-managed teams' implementation and decision-making processes. This chapter includes segments to review various behaviors of social beings with a summary of patterns at the end of the chapter to summarize what may constitute self-managed team biomimicking behaviors.

The purpose of this qualitative descriptive multiple case study was to present common implementation strategies, such as decision-making processes, experienced by self-managed team members in an IT company in Toronto, Ontario, who use behaviors exhibited in intelligent swarms. Chapter 2 includes the strategy for the literature search, a description of the study's conceptual framework, and a literature review on self-managed teams and decision-making processes, as well as how social beings overcome similar

challenges. The chapter will end with a discussion of the gap in the literature and a summary of the review.

Literature Search Strategy

I studied and reviewed scholarly books and journal articles to understand the challenges of self-managed teams and to discover how social beings work and ways their behavior may provide an approach to address self-managed teams. To ensure consideration of all relevant topics, I reviewed scholarly journals on the subject and conducted an extensive search of each topic. I used Walden University Library as an entry point for research in various databases, including Business Source Complete, Social Science Citation Index, Emerald Insight, IEEE Xplore Digital Library, Directory of Open Source Journals, and others partially depicted in Table 1. I used various keywords for the same concept (for example, *self-management* and *self-organization*) to ensure comprehensive coverage of topics. Keywords searched included *self-management, self-managed teams, self-organization, challenges of self-managed team, groupthink, group decision making, biomimicking, swarm intelligence, consensus, group cohesion, group synergy,* and *swarm behavior*. I also used a combination of words with *self-managed teams,* including *leadership, success, failure, decision making, decision process, structure, setup,* and *implementation*.

Table 1

Literature Search Strategy

Keywords	Databases	Scholarly journals
Self-managed teams, performance	Science Direct	*Journal of Business Research*
Self-managed teams, challenges	IEEE Xplore Digital Library	*International Conference on Computational Science and Its Applications*
	Business Source Complete	*Team Performance Management*
Self-managed teams, groupthink	Gale Academic OneFile Select	*Human Relations*
	Business Source Complete	*Organizational Behavior & Human Decision Processes*
Self-managed teams, success	Gale Academic OneFile Select	*Journal for Quality and Participation*
Swarm intelligence	Walden University Library Catalog	
	Business Source Complete	*California Management Review*

Conceptual Framework

In addition to traditionally managed teams, organizational leaders can implement self-managed teams in which members act autonomously and self-regulate resource allocation and decision making. Self-management is based on economic science popularized by various social and political movements. The conceptual framework incorporates the constructs of teamwork and team decision making, including the sociobiology theory presented by Wilson (1978). I cross-examined the concepts of teamwork with nonhuman social being behaviors such as swarm intelligence. This framework includes the self-management and nonhuman social behaviors that leaders can use to facilitate an implementation approach for self-managed teams.

Organizational self-management is based on self-determination theory (SDT) that focuses on the motivations behind the choices people make. Deci (1971) recognized two types of motivation: intrinsic and extrinsic. Intrinsic motivation comes from within, driven by factors that cause individuals to maintain their efforts. Extrinsic motivation comes in the form of rewards presented for completing a task. When people are intrinsically motivated, they perform better and achieve higher performance outcomes.

Deci and Ryan (2012) identified three types of motivational needs that, once satisfied, present opportunities for high performance and growth: competence, relatedness, and autonomy. According to SDT, humans proactively work on mastering their inner forces, have growth tendencies, and seek optimal actions. Understanding these needs to foster innate motivation and initiate growth is a critical element of self-management.

In embedded social contexts such as a team setting, intrinsic motivation leads to higher levels of success (Deci & Ryan, 2012). With the three pillars of intrinsic motivation (autonomy, competence, and relatedness), autonomous motivation provides a path for individual growth (Gerhart & Fang, 2015). Leaders must use autonomous motivation in self-managed team implementation to encourage members to better their performance. When team members are ready to participate in teamwork, they improve performance at the team level.

Team members who work together divide the work to achieve goals more effectively (Guchait, Lei, & Tews, 2016). The team must be implemented and built to provide opportunities for teamwork. In accordance with teamwork theory, team members

go through four stages: forming, storming, norming, and performing (Tuckman, 1965). During the forming stage, team members familiarize themselves with each other. In storming, differences cause conflicts. Next, team members shape processes in the norming stage, entering the performing stage. After normalization of teamwork, team members enter the performing stage and start working and getting their job done in an orderly fashion. In traditional team management, the manager controls and facilitates these steps. The teamwork theory applies to self-managed teams; however, self-managed teams do not have assigned managers, which is why team members should receive the proper tools and training to progress through these stages.

Team members must learn from one another as part of the growth and knowledge transfer processes. Bandura proposed social learning theory in 1971, positing that individuals could learn new behaviors by observing and imitating others. Leaders may set up the learning process to receive direct reinforcement (Bandura, 1979). Traditionally, managers administer reinforcements in the form of rewards. The implementation of self-managed teams should provide clear guidance in the contribution and distribution of rewards.

Decision theory is also an applicable theory to this study—specifically, social choice theory, which includes decisions that involve more than one decision-maker. The social choice theory incorporates the mechanisms for people's participation during decision-making processes. In 1951, Arrow presented social choice theory. At the core of the theory, the general possibility theorem posits that individuals could not make social choices that meet all requirements without options or constitutions that present

alternatives (Arrow, 2012). This theorem indicates the drawbacks of voting systems. In traditional team management, the manager makes the decisions based on a collection of inputs. Addressing these challenges may require entirely different approaches, such as learning from nature and mimicking observed nonhuman social being behaviors.

Wilson (1978) supported the benefits of biomimicking and the use of swarm intelligence with sociobiology theory. Wilson suggested that evolution could be one way to explain social behaviors. Regardless of natural selection, the driving force of evolution indicates that members of self-managed teams can learn group collaboration from social beings to improve teamwork.

The framework for this study includes the theories presented, with the focus on sociobiology, teamwork, and social choice theories. Self-managed teams need members who collaborate to achieve the team's goals. SDT provides the innate attributes that team members require to facilitate productivity in team settings (Deci & Ryan, 2012). Self-managed teams align with the pillars of SDT, as self-managed teams provide members with the most opportunities to exercise autonomy. Team members can integrate the stages of Tuckman's (1965) teamwork theory into their self-managed teams. This study provides the settings for these stages, along with how decisions are made using social choice theory with a lens of sociobiology.

Learning and growth are fundamental aspects of teamwork. Social learning theory provides the constructs that team members need to achieve personal growth while completing tasks at the team level. Research on the implications of social choice theory indicates support for the theoretical framework of decision making (see Arrow, 2012).

Each team member has a utility function when making decisions or voting. In team decision making, team members must maximize the aggregation of utility functions. I examined these theories through the sociobiology lens to integrate an understanding of an organic approach for self-managed teams.

Self-Managed Teams and Biomimicking

In this section, I analyze the literature on self-managed teams with a comparison against traditionally managed teams. I focus on the challenges that members of self-managed teams encounter and compile a list of the potential shortcomings of self-managed teams not faced by members of traditional teams that require adaptive setup. Then I examine the approaches in biomimicking and intelligent swarms to show how nonhuman social beings in intelligent swarms solve similar challenges.

Self-Managed Team Overview

Members of the self-managed team receive minimum guidance and influence from outside of the team on activities such as planning, organizing, and controlling (Vancea, 2015). Members have this authority to improve productivity (Gunawan & Saraswati, 2018). Many organizations, including 80% of Fortune 1000 companies, have integrated self-managed teams in their structures (MacDonald, 2019). Leaders of self-managed teams should use new approaches to manage the goals and outcomes of their teams and adapt to various work schedules, work methods determination, supervision, and rewarding systems to enable team members to achieve their expected goals.

Why Self-Managed Teams?

Members of self-managed teams present 60% more competence in competency factors (like teamwork, cohesiveness, and team dynamics) compared to traditional teams (Kauffeld, 2006), leading leaders to expect members of self-managed teams to work with higher levels of efficiency. Employers who use self-managed teams may improve motivation, productivity, and performance (Elmuti, 1997). In addition, members of self-managed teams may perform better in certain areas of teamwork than members of traditionally managed teams.

Members of self-managed teams "[bring] down decision-making to the level of operational problems and uncertainties and thus increase the speed and accuracy of problem-solving" (Moe, Dingsøyr, & Dybå, 2009, p. 855). Team members decide all aspects of work and increase efficiency, cost savings, and productivity, among other benefits. Because self-managed team members have more autonomy and authority, they make better decisions about various work aspects, including approach, roles, responsibilities, and rewards. Accordingly, the teams are more efficient and better performing.

Basics of Self-Management and Levels of Application

Manz and Sims (1984) asked a fundamental question: How do leaders expect to run work through employees without managers? Given the right setup, team members can collaborate to address the functions of a traditional manager. The exact approach will differ depending on the implementation of the self-managed team. As elaborated in the following sections, some of the solutions in response to Manz and Sims's question are

alternatives such as sharing leadership, setting appropriate processes, and assigning facilitators.

Shared leadership in self-managed teams indicates higher levels of efficiency and stronger transactive memory systems (Solansky, 2008). According to Solansky (2008), team members use a transactive memory system to perceive, store, and retrieve knowledge. Self-managed team members may be able to use transactive memory systems to reduce the effects of groupthink by establishing more synergy, which undergoes exploration in the following sections as one of the main challenges of self-managed team members. Members of self-managed teams may not need a single, traditional leader due to multiple shared leaders who provide regular motivational, social, and cognitive support (Sousa & Van Dierendonck, 2016). Sousa and Van Dierendonck (2016) indicated that there are two shortcomings of shared leadership, however. First, shared leadership provides benefits for all types of teams and not just those that are self-managed, making it hard to segregate the effect of shared leadership in association with self-management. Second, informal leadership functions may produce part of the effects observed in team management, leading to inaccurate measurements.

Organizational leaders need to change their structures to benefit from self-managed teams because of not having a manager directly responsible for making decisions. Many organizational leaders use self-managed teams to drive organizational changes (Gupta et al., 2017). Three basic principles underlie self-managed teams: (a) assigning team members the responsibility and accountability of taking on and assigning complex tasks; (b) moving from team member level to team level, allowing team

members to set and fine tune their own processes and assign managerial tasks to themselves; and (c) reaching a balance between organizational and employee interests (Gupta et al., 2017). The process of building a self-managed team starts with uniting people who eventually form groups, teams, and finally, self-managed teams. Research by Gupta et al. (2017) showed the presence of a facilitator has led to more success when performing these organizational and structural changes. The presence of a facilitator or a shared leader can help with the transformation of existing teams to self-managed teams.

The concept of self-managed teams is not limited to large organizations or specific industries. Page-Shipp, Joseph, and van Niekerk (2018) found that in leaderless self-conducting and traditional singing groups, all team members felt empowered to take leads and used cues from others for coordination during their performances. Despite such potential, the scope of this research remained in the IT industry.

Although outside of the scope of this study, an entire organization can be self-managed, too. The conditions of self-managed organizations differ from the organization of self-managed teams. The approach for a self-managed organization starts with fundamental decisions on the decentralization of authority, levels of self-organization, and application of the required changes (Lee & Edmondson, 2017). Based on the approach presented by Lee and Edmondson (2017), employees of certain organizations may have different levels of ability to decentralize work execution, managing and monitoring, organizational and work design, resource allocation, performance management, and strategy. After employees decide upon the level of self-management, they must establish a formal system to codify the decentralization approach, next

applying the self-management processes organization wide. Although a few companies have opted to move toward self-management, there are basic gaps and challenges in required team success levels; accordingly, the focus of this research remained on self-managed teams and not self-managed organizations.

How to Build a Successful Self-Managed Team

The transition from a traditional team to a self-managed team requires planning in all aspects, including leadership, authority, and decision making. For example, the transition of authority may occur in five stages:

1. understanding one-on-one interactions between the manager and the team members,
2. leading interaction to happen between team members by the manager,
3. taking a coaching role by the manager,
4. team members step up and provide leadership on key team processes and engage others, and
5. leadership enters its peak level, freeing the manager to attend to higher initiatives than managing the team (Liff & Gustavson, 2016).

Appelbaum, Bethune, and Tannenbaum (1999) showed that organizational leaders might plan self-managed teams due to downsizing; with the right planning and execution, organizational resources can produce more productive team members. As traditional team members join self-managed teams, they start taking active ownership roles. Developing and managing knowledge within the team become key contributing success factors (Wageman, 2001). Watson, Michaelsen, and Sharp (1991) examined team members'

familiarity with each other and the effect of familiarity on group-versus-member problem-solving processes. Findings showed that, as team members gain experience, the influence of more experienced members becomes less essential, something directly related to decision making, groupthink, and inclusion of experience in team decision-making learning exercises. The improvement in decision making may not immediately appear after setting new processes, enablement, and empowerment, as improvement may take time and effort until team members can provide their true team-added value.

Self-Managed Team Challenges: Leadership

Leadership and decision-making processes differ between self-managed teams and traditionally managed teams (Barry, 1991). The traditional leadership approach with a leader making decisions does not apply to self-managed team members, as it is not easy to set up a functioning team without a leader. The leadership of self-managed teams should stem from four elements: envisioning, organizing, spanning, and socializing. Envisioning and organizing leadership are self-explanatory and common within traditional leadership. Spanning leadership includes activities that occur outside of self-managed teams within or outside of the organization. In social leadership, multiple leaders take on the tasks of a traditional manager. Social leaders develop and maintain team members' socio-psychological perspectives on concerns, challenges, being heard, and bringing fun and humor to the team.

Although self-managed team members exhibit higher levels of competency and productivity, they also face deficiencies and drawbacks. Batt and Appelbaum (1995) stated that establishing self-managed teams takes time, resources, and training. Members

of self-managed teams may experience challenges such as friction between team members and other organizational employees.

Yeatts, Hyten, and Barnes (1996) compared two self-managed teams, one with members struggling with multiple challenges and the other with members working together smoothly. The researchers concluded that the differentiating factors were team environment, team design, team process, and work process. Decision-making, noted as the most significant advantage of self-managed teams requires full team involvement with consensus or a majority vote that replaces traditional leader directives. Yeatts et al. (1996) confirmed that successful self-managed teams did not have a dominant member in the decision-making process; all members made decisions, with the most knowledgeable person in a particular situation having the most input. Team members should be able to discuss and resolve their differences to reach a consensus or, at a minimum, avoid harboring resentment toward their colleagues. Members of the struggling team took similar approaches, but the supervisor/facilitator tried to dominate the decision-making process. As a result, other team members excluded the supervisor/facilitator, but in the process, they lost his input and his vast expertise.

Wageman (1997) examined a similar situation among Xerox employees and compared the success and failure of self-managed teams that led to the discovery that team members needed successful coaching behavior to succeed. Proper coaching provided self-management reinforcement, appropriate problem-solving consultations, and organizational data and information. Poor coaching led to negative outcomes, with team members singled out based on their outcomes, with managerial interventions and

overridden team decisions. Wageman compiled a list of activities for traditional leaders and changed the role of leaders to designers, facilitators, and coaches.

Self-managed employees take part in collective responsibility and self-monitor their performance (Wageman, 2001). Self-managed team members need support as well as proper coaching to succeed. Stewart, Courtright, and Manz (2011) contrasted and compared self-managed leadership at different organizational levels. Although they did not find consistent results at the team level due to influences from external leaders, they found improved performance at the team member level after the application of self-managed leadership. Leaders must consider and control the effects of external leadership to measure the success of self-managed teams.

Lee and Paunova (2017) researched the effect of learning goal orientation (LGO) on leadership. An individual engaged in LGO strives to develop the self through learning. The researchers proposed and tested this relationship in self-managed team members, concluding that, although a self-learning person feels safer in a self-managed environment and behaves in a leadership role, there are other contributing factors to success. Team members must link LGO and contextual role behavior to achieve the self-organizing goal. In other words, social exchange and goal orientation cause the required leadership outcomes. Team members will not be able to influence team outcome and performance—even if they have identified goals and use LGO to align with those goals—until they combine their goals with the adequate social exchange.

Shared leadership is a strong substitute for a traditional leadership role. Self-managed team members can use the shared servant leadership model when and if they

need a point of reference or external direction. Team members who take part in servant leadership work toward stronger team behavioral integration (Sousa & Van Dierendonck, 2016). Team members can use servant leadership to promote proper information exchange between team members. The success of the role is measurable through four elements: empowerment, humility, stewardship, and accountability. Sousa and Van Dierendonck (2016) found a direct correlation between the application of these four measurements and internal and external communication, and improved team member performance.

Self-Managed Team Challenges: Non-leadership Aspects

Chang and Curtin (1994) found that members of self-managed teams must overcome many challenges. Self-managed teams have different basic functions than traditional teams, with regard to such elements as leadership, communication, process improvements, team dynamics, project management, conflict management, consensus decision-making, peer coaching, feedback, group problem-solving, and interpersonal relationships. Self-managed team members must redefine each of these functions as new processes.

It is important for organizations to properly establish self-managed teams and give members the necessary training to succeed. Many factors may affect these preparation activities. In addition to leadership challenges, organizational leaders should measure the abilities of team members with an appropriate scale. Employers can measure collective efficiency, conflict resolution capability, transactive memory systems (how much team members perceive that each of them possesses team knowledge), and role

charts (Solansky, 2008). The team designer may not be able to control all the active variables, including team size and team members' familiarity with each other. Additionally, members' different personalities, frames of reference, and values may also affect teamwork.

Gupta, Huang, and Yayla (2011) measured the effect of collective transformational leadership on the performance of self-managed team members. Leadership is a collective process, with team members performing leadership functions such as motivation and inspiration. Gupta et al. (2011) found that social capital positively correlated with team performance. Self-managed team members who experienced cohesiveness and social capital performed efficiently, whereas managed team members who lacked social capital struggled. It is, therefore, necessary to use team members' past experiences (same characteristics as social capital) as control variables to measure self-managed teams' success (Solansky, 2008).

Moe et al. (2009) evaluated self-managed team members in different companies and identified team-level and organizational-level barriers. Team-level barriers include personal commitment, team member leadership, and failure to learn; in turn, organizational-level barriers include shared resources, organizational control, and specialist culture (generalists who have a range of skills and specialists who focus on specific expertise); as the team relies on these individuals for their contribution, work culture may present a barrier. Moe et al. (2009) suggested cross-training, team member proximity, appreciation of generalists, trust and commitment, and a one-project-at-a-time rule.

Self-managed team members may also struggle with groupthink. Stating that self-managed team members are at a higher risk of groupthink, Neck and Manz (1994) offered *teamthink* as the alternative to groupthink. With teamthink, a method of thinking within the whole team, team members consider diverse views, openly express or hear ideas and concerns without judgment, recognize team members, and discuss collective doubts.

Although self-managed team members enjoy increased flexibility, team members may experience limits and dysfunction due to conflicts, less personal autonomy, and reduced task interdependencies (Gupta et al., 2017). Members of self-managed teams face five types of conflicts: task, relationship, process, inter-sender (requests that conflict with other requests or organizational policies), and resource-related (Bishop & Dow Scott, 2000). Although these conflicts are not specific to self-managed team members, self-managed team members may experience more challenges when attempting to resolve these conflicts independently. In a study of 131 North American companies undergoing organizational change, Gupta et al. showed that self-managed team members are 30% to 50% more productive. Researchers also observed that the major obstacle to self-management is the people, and specifically managers. For self-managed team members to succeed, both employees and managers must support the transition to self-managed teams.

Most, if not all, aspects of teamwork have variances in self-managed states. Global teamwork and collaboration are factors that include multicultural perspectives into the combination of success factors. Team members who receive learning orientation

overcome multicultural challenges and enable collective global leadership (Paunova & Lee, 2016). Other crucial success elements include supporting positive intra-team environments based on trust, safety, and shared identities and advocating strong learning environments. Teams of people with the same cultural backgrounds in major metropolitan areas are rare. Organizational leaders who ignore the noted differences put teamwork at risk and more so in a self-managed team setting, as teamwork is more crucial due to differences with traditionally managed teams.

Understanding Decisions in Teams

Self-managed team members engage in different decision-making processes than members of traditional teams. In traditional teams, the assigned leader or manager evaluates a situation and makes a decision; because self-managed team members operate without an assigned leader or manager, they must make decisions differently. In the following sections, I review decisions and decision-making processes and explore gaps in the existing approaches.

Decision-making in teams: In the traditional decision-making process, a manager uses prior experience and situational context to decide upon the best approach. Given the spatial differences between the design of the classical decision theory and today's complex and dynamic world, there is a need for new decision-making approaches (Beach & Lipshitz, 2017). The technological scene changes faster than that in other industries, so decision-making processes that provide the best outcomes can indicate a significant difference.

The alternative to traditional decision-making is the process of allowing team members to participate. This concept is indeterminate and overlaps with the roles of each team member (Halvorsen & Sarangi, 2015). Activity roles are team members' core activities. Discourse roles are how team members communicate about their activity roles and how team members may influence other activities. The indeterminacy and overlap of these roles within the team's context provide team members with opportunities to contribute to that decision-making process.

The aforementioned roles indicate that elements of decision distribution to team members already exist, which self-managed teams can utilize. Team members should be able to contribute to decision-making while acting in their organizational roles. With some rule-setting at the beginning of the teamwork arrangement, it is possible to identify the influence of team members in their organizational roles with subsequent direction toward the desired direction (Halvorsen & Sarangi, 2015).

Team members must also have information availability and ambiguity when making decisions as a group (Beersma et al., 2016). Sometimes information is not available due to spatial factors, as well as data extraction, cognitive levels, and ambiguity elements. Beersma et al. (2016) stated that although the need for structure is an asset when information ambiguity is low, the structure becomes a liability when ambiguity is high. In other words, when the level of unknown elements for decision-making increases, team members can do better if they feel comfortable with less structure in the decision-making process. The need for comfort is applicable in self-managed teams, as the traditional structure of the organization may not be available for decision-making.

Self-managed team members need methods to reach a general agreement or consensus. One proposed model relies upon the expert-level in a general agreement model to achieve the desired level of consensus (Pérez, Cabrerizo, Alonso, & Herrera-Viedma, 2014). In the traditional model, the decision-maker uses a weighting system, which presents each expert's relevance and importance and, through a feedback mechanism, allows team members to optimize decisions. Members of heterogeneous teams can use the traditional model when experts with different importance and relevance must work together. This model is a notable approach because, in real-life situations, more experienced experts should have higher stakes in each decision, leading to an inclusive and more efficient decision-making model.

Team members must make decisions for different types of tasks, and some decisions may be easier than others. Self-managed team members can use decision-making based on task variety in a model to provide a configurational approach for various team tasks. Decentralized design and centralized technical work indicate improved team coordination (Kudaravalli, Faraj, & Johnson, 2017). Self-managed team members benefit from guidelines and structure while maintaining authority in a subset of activities where team members are better equipped for coordinated tasks such as decision-making.

As for decision-making in real life, models such as recognition-primed decision-making provide more naturalistic options than traditional decision-making models (Klein, 2008). Today's complex and fast-paced world presents the opportunity for such models to serve as alternatives or replacements of traditional models. Members of any team,

including a self-managed one, should consider the challenges of traditional models and adopt models they can use to better handle time, change, shifting goals, and uncertainty.

The social choice theory presents decision-making options for self-managed team members. Self-managed team members can use social choice theory to resolve situations where preferences among population members cause loops leading to paradoxical states. There are many aspects to consider regarding social choice theory. For example, does resiliency contribute to decision-making and other social functions? Olsson, Jerneck, Thoren, Persson, and O'Byrne (2015) discovered that resilient team members negated constructive collaboration. The natural inclination to replace a manager's decision-making responsibility is to achieve consensus. Team members may struggle to reach absolute consensus (Cabrerizo et al., 2015) or even partial consensus, referred to as soft consensus (Herrera-Viedma, Cabrerizo, Kacprzyk, & Pedrycz, 2014).

Systems of decision-making: Team members can use established systems such as consensus decision-making, voting-based methods, Delphi method, and dotmocracy (allowing members to use a set number of dots to choose and vote for more important items) to improve group decision-making processes. Team members require a process known as a decision support system (DSS) to execute any of these systems. In a DSS, alternatives can be incorporated into the process. Examples of DSS include gatherings (involving everyone), subcommittees, or participatory contribution (having a say proportional to stake). In this section, I explore these systems and approaches.

In consensus decision-making, group members help and participate in finding a decision that best supports group members' overall interest. Challenges arise quickly:

What if some members do not agree with the resulting outcome? The group can come to unanimous agreement, near-unanimous agreement, or full consent instead of full consensus. Certain complex models (Liao, Xu, Zeng, & Xu, 2016; Pérez et al., 2014) have fuzzy logic to keep members active in the decision-making pool, but using these processes is not easy or in formats that team members can apply to general decision-making situations. The simpler options include unanimous agreement minus one or two votes, Condorset consensus or voting (voting on a preference/priority basis), a supermajority (with set thresholds such as 90%, 75%, or 60%), a simple majority, or escalation of the decision to a committee or leadership.

Team members who use the general consensus-based approach share information through active listening and allotted speaking times for each member to allow everyone to be heard. Team members resolve differences through discussion and do not record names for solutions or ideas. If unresolved objections occur, objecting members are allowed to stand aside or block the whole process. Consensus-oriented decision-making, popularized by Harnett (2011), provides a step-by-step approach that members can use to make decisions. Decision-making steps include framing the topic, open discussion, identification of concerns, collaborative proposal building, selection of direction, final proposal synthesis, and closure.

Self-managed team members must account for emotions if they use biomimicking in the decision-making process. Implementing recommendations from Lerner, Li, Valdesolo, and Kassam (2015) will help organizational leaders who are implementing self-managed teams to form a model that includes important methods of directly and

indirectly dealing with emotions in the decision-making model. Beshears and Gino (2015) proposed that leaders act as “decision architects” to help handle emotions and biases. As decision architects, leaders change the work environment to trigger the right emotions and biases by simplifying processes or increasing accountability.

Group Decision-Making, Aspects, and Challenges

Groupthink. Groupthink is a situation that occurs when subgroups of team members drive team decisions that may not include all courses of action (Janis, 1971). Team members may struggle with groupthink and weakening the chance of establishing cohesion, as the occurrence of groupthink can be significant drawback of self-managed teams. In self-managed teams, the lack of a designated central leader often causes smaller groups of members within the team to use their experience, influence, or personal agendas to overestimate, underestimate, and maintain closed-mindedness. Generally, structural issues within the team, situational context, and high cohesiveness within sub-teams cause groupthink. Lack of team structures and potency can also lead to groupthink. Team members who engage in groupthink negatively affect team cohesion and members’ well-being (Markova & Perry, 2014). Because self-managed team members may be prone to groupthink, members of self-managed teams should be equipped with strategies to avoid groupthink in the team setup.

Each team member should be able to object to proposed decisions to avoid groupthink. Leaders should avoid voicing opinions and evaluate all alternatives. For each solution, a designated opposing member should challenge the solution, offering improvement by proposing further improvements. Team members should reconcile their

different perspectives through negotiation (Neville, 2017). Usually, team managers are responsible for providing such an environment. In the case of a self-managed team, addressing groupthink will present as a gap.

Whereas the dominance of a few members through groupthink may have negative effects, team members who overanalyze also present drawbacks. Kelman, Sanders, and Pandit (2017) researched decision-making processes in the U.S. government and found significant delays in decisions due to overanalysis. In accordance with rigorous existing system processes, decisions follow vigilant decision-making; in comparison, subcabinet executives dealt with latencies caused by overanalysis. Team members can resolve groupthink through processes; however, overanalyzing team members also cause problems. Members need decisiveness and preference for action to improve their performance from good to great.

Due to the influence of online communities, team members of many organizations can function virtually. Groupthink may appear or occur differently in online communities. Lee et al. (2016) investigated the antecedents of groupthink, including cohesion, structural faults, and provocative situations. They revealed that virtual team members tend to overestimate their work, which is a symptom of groupthink. Structural changes and provocative situations indicated closed-mindedness, another symptom of groupthink.

Self-managed team members may amplify the effects of groupthink due to team design; accordingly, team members should integrate methods of avoiding groupthink into the teamwork design. Paxton (2015) suggested considerations for appropriate design that

team members can implement to reduce and address groupthink, such as the environment, decision-making processes, facilitation, education, and full team involvement. The aforementioned research studies only presented data on team members who are supervised by managers. Any implementation strategy has to address the gaps of groupthink and overanalysis in self-managed team design and setup.

Group decision-making synergy. Self-managed team members need to find successful decision-making approaches. A factor of team decision-making is members' abilities to use team synergy to make more effective decisions than decisions made by each team member. In organizational terms, synergy occurs when members work together as a group and outperform individual members. Positive team synergy indicates success in the absence of dedicated leaders.

Sassenberg, Landkammer, and Jacoby (2014) confirmed that team members who allow personal biases work against group decision-making processes. A possible resolution involves minimizing the effect of personal biases. When team members focus on the specific problem together, they work toward higher synergy levels. Team members can measure synergy levels by establishing an effective process in which team members share information about their backgrounds and their desired outcomes from the decision or group activity.

Tantalo and Priem (2016) provided a new stakeholder synergy model that organizational leaders can use to consider higher and broader levels of stakeholder involvement and strategic alignment. The top manager who provides the right strategy can be the driver of the right stakeholder views to achieve more synergy. The effects of

cascading strategy show the significance of proper guidance for all employees, especially self-managed team members, as they require strategic guidance to make decisions with minimum supervision.

Team members may struggle with information processing during decision-making processes. Due to technological advancements, there is more information available, along with a variety of tools and channels, thus decreasing the attention at team member, team, and organizational levels. Van Knippenberg, Dahlander, Haas, and George (2015) reviewed research studies on information processing and decision-making and concluded that focused team members helped the teams in those two key areas. Team members can use models for self-managed teams and decision-making to narrow their information input to appropriate considerations to avoid loss of attention.

Group decision-making: Cohesion. Group cohesion is a critical factor for successful synergy. As group cohesion increases, interactions and communication levels go up. Team members with cohesion collaborate and coordinate at a higher degree (Gächter, Starmer, & Tufano, 2017). A team model should provide tools to increase cohesion. Used as a measure of team success, cohesion may be apparent in both personal psychology and team psychology.

Self-managed team members must increase team cohesion to achieve better results, especially in decision-making. Watson-Jones and Legare (2016) posited that one of the benefits of team ritual—practiced behavior—is increasing social cohesion. Individuals who engage in rituals positively affect cohesion and decrease conflicts.

Rituals may include work procedures and nonwork activities, such as dining, gaming, and social events, in which team members can participate to increase team cohesion.

To successfully create team cohesion, team members should consider all relevant factors, including common goals, interests, and member satisfaction. Self-managed team members should integrate these factors into the setup of their teams. Garcia-Guiu Lopez, Molero Alonso, Moya Morales, and Moriano Leon (2015) found that authentic leadership has a positive effect on team cohesion and identification. Team members who use authentic leadership promote positive psychological awareness and positive ethical environments, transparency, balanced information processing, and cultural awareness. Authentic leadership is another element that self-managed team members can apply to the design of their teams.

Group decision-making cohesion issues: Polarization and groupthink. Two issues have negative effects on cohesion: polarization and groupthink. An outlet of polarization, referred to as the risky shift phenomenon, occurs as team members take higher risks when making decisions within team settings than when making the same decisions alone. Team members may experience counterproductive polarization when group members' initial consensus becomes extreme or when members ignore facts in favor of the initial verdict (Crandall & Sherman, 2016). The process of avoiding polarization requires manager support and proper set-up in a self-managed team setting, which is a current gap in the literature.

According to Maltarich, Greenwald, and Reilly (2016), the team's overall goal may differ from team members' individual goals. If the difference between goals of team

members and team is noted in setting up the team, team members can better understand and adjust team inputs, processes, and outcomes. Self-managed team members must realize that team polarization occurs due to influential individuals who may directly or indirectly persuade others to follow them in group decisions.

Group polarization is one of the main challenges of team performance (Mathieu, Hollenbeck, van Knippenberg, & Ilgen, 2017). Team members need cohesion to improve decision-making and polarization has a negative effect on decision-making. Polarization is a demonstrated behavior in court and jury members' decision-making processes (Roux & Sobel, 2015). Self-managed team members may experience augmented effects of polarization due to a lack of direct supervision. Accordingly, self-managed team members must address polarization during the setup of their teams.

When group polarization and pressure to conform occur, team members may struggle to make decisions due to escalating tendencies and the inclination to expend more resources to justify previously used resources (Dybå, Dingsøyr, & Moe, 2014). Resources may be the money or time dedicated to a previous commitment and could be as implicit as the time spent in meetings to explain previous decisions. When polarization occurs, team members or smaller groups of members within the team spend part of their time and energy to further their investments in areas that do not merit additional resources. Managers track polarization patterns as risks. Leaders setting up self-managed teams should establish a process to check risk patterns and provide corrective guidance.

Self-managed team members can mitigate the risk of decision-making polarization risk by using deliberative norms (Strandberg, Himmelroos, & Grönlund,

2017). Deliberative norms are simple rules that members communicate and facilitate within the team. Self-managed team members can use deliberative norms to provide opportunities for discussions instead of arguments to reduce group polarization. When team members exchange ideas, they can express thoughts and opinions, have the right discussions, and foster true alignment without polarization to make decisions.

Decision-making in self-managed teams. The transfer of authority from leaders to team members differentiates self-managed teams from traditional teams. This difference is noticeable in decision-making events. In an organizational hierarchy accepted by team members, the quality of decisions, the support of decisions and as such, the performance is high (De Hoogh, Greer, & Den Hartog, 2015). The psychological safety of team members' buy-in provides opportunities for teams to overcome autocratic behaviors like groupthink. In self-managed teams, however, this process does not work. In self-managed teams, therefore, team members should replace managers' roles with processes as a part of the team setting. One of the team members in each case may assume the role of facilitator to execute the process (Pierce & Horkings, 2016). With the right setting and execution of the decision-making processes, self-managed team members make more effective decisions because they know the job better than anyone else.

How can self-managed team members make better decisions? Lim and Lee (2015) discovered that if the team members shared a mental state, the effectiveness of the team and decision-making outputs increased. Team members can share a mental state when

they receive appropriate, adequate information and facilitate discussions before decision-making.

Cordes (2016) reported that team members equipped with action processes made successful decisions. Action processes include formulation review, coordination, and decision-revisiting. Team members who follow action processes improve performance when they review, discuss, and revisit team decisions.

Self-managed team members should refine the decision-making process in their team setting so they can make better, more inclusive decisions to reach a consensus. Because they share both decisions and consequences, team members can implement shared decision-making by studying the consequences of different levels of the organization (Elwyn, Frosch, & Kobrin, 2015). This model provides opportunities for team members to participate in the decision-making process, as they are directly accountable for the consequences.

Organizational leaders may use self-managed teams to foster participation among all members because whole-team participation leads to better performance for processes such as decision-making. The traditional models of team management and decision-making include managers who perform those tasks. The literature review showed a need for implementation approaches that include consequences at personal, organizational, and higher system levels and can provide feedback for better decision-making processes.

Self-organization background. Self-organization occurs when simple rules produce complex patterns (Fisher, 2009). Researchers can observe self-organization at atomic levels up to human societies. In a crystal, atoms align in specific ways. Those

crystals then form patterns in seashells. The complex structure of the seashell began with atom formation in crystal patterns that led to a much larger structure. In this case, the primary forces are simple rules of force between atoms. The premise in self-organization is the same, as there is no central director other than simple rules.

For a team to become a self-organizing entity, team members should respond collectively to internal and external changes, thus becoming a complex adaptive system. Members of this adaptive system show intelligence when they collectively react to changes in smart and appropriate ways. Swarm intelligence is an emergent property of teams that enables members to resolve challenges and problems in ways that would not otherwise be possible at team-member levels.

For collective adaptability to occur, Miller and Page (2009) proposed eight criteria loosely based on Buddhism's path. The eightfold path includes right view (ability to receive and understand others), right intention (a common goal that they all want to achieve), right speech (ability to send and receive information), right action (ability to influence others by doing something), right livelihood (rewarding system; reason for participation), right effort (strategies to work and function with others), right mindfulness (same or similar rationality), and right concentration (ability to focus on the event or the task with the highest priority). Each of the paths can apply to different levels of life forms; for example, humans use languages and body gestures to communicate, and cells in the human body use chemical substances to send messages. Wrong chemicals or wrong words do not work.

Social beings (including many species of animals and insects) generally follow simple swarm intelligence rules as if they are working together or led by a leader or an entity with a different level of intelligence. For example, each fish in a school moves in the same direction as other nearby fish, maintains distance from neighbors, and changes direction and follows neighbors when other fish alter their path. Fish use these rules to escape from danger and move toward food or a better location.

Team members who make decisions in business settings need more complex processes than just moving together, but the underlying idea is the same. If team members can follow simple rules to lean toward one of the options in a decision-making process, the movement of schools of fish is not far from a decision-making model. Complex mathematics indicates that in responding to questions with definitive answers, the group members as a collective always outperform individuals. Page (2007) presented the diversity prediction theory, which indicates that collective error is equal to average participating person error minus prediction diversity. Therefore, decisions made or actions taken by collective group members always provide better results with higher diversity.

Members of complex societies use simple rules in decision-making approaches for productivity. For example, baboons follow different directions from dominant herd members when the degree of disagreement is high (Strandburg-Peshkin, Farine, Couzin, & Crofoot, 2015). Baboons choose paths of movement by using simple voting systems in which they stand closer to the path they prefer to generate a democratic collective action.

Group decisions have received centuries of study. Marquis De Condorcet published *Application of Analysis to the Probability of Majority Decisions* in 1785, in which he set forth what is known as Condorcet's jury theorem. In this theorem, Condorcet theorizes that the quality of the decision-making process does not necessarily improve with the number of voters. The probability that each voter will decide correctly indicates the quality of the decision-making process. If this probability is less than 50%, increasing the number of voters may cause a wrong decision. This is the simplest version of the main theorem, as researchers have presented many varieties and applications of Condorcet's theorem (Nitzan & Paroush, 2017).

Fisher (2009) presented rules that team members can use to improve decision-making processes and teamwork. Fisher includes approaches for dealing with groupthink, decision-making alternatives, teamwide inclusion, and choosing pragmatism over idealism. For example, members can avoid groupthink by stepping away from the situation to think individually. Also, team members can plan for emergencies so that making rapid decisions becomes simpler due to what team members have already discussed about boundaries, priorities, timing, and exit rules.

To foster alignment and stronger decision-making, team members need to equally allocate resources to alternative decisions; investigate alternatives thoroughly before dismissing them; present issues for all team members; study how members of more successful teams approach tasks; and, once ready to decide or vote, choose the most practical method over the ideal method (Fisher, 2009). These simple rules, once properly

set up as team processes, can provide guidance at the team-member level for improved teamwork and quality decisions.

Intelligent Swarms

The concept of learning from the natural models and mimicking them is not new. The purpose of this study is to present how social beings work together and demonstrate group-level intelligence, as well as determine whether members of successful self-managed teams exhibit this behavior in various activities such as decision-making. Karaboga, Gorkemli, Ozturk, and Karaboga (2014, p.14) defined swarm intelligence as "the collective behavior of decentralized and self-organized swarms." Many organisms, including insects and animals, collaborate to accomplish larger goals and objectives. Each member of the group follows simple rules perfected over millions of years of evolution.

There are similarities between the activities and goals of these swarms and a team and its members. In intelligent swarms, members lack designated leaders. All swarm members are equal, and they work together to solve a wide array of challenges, something well researched in mathematics and computational models. Researchers have applied swarm intelligence to a range of problems, including finding optimized solutions, applying probability distributions, dealing with different numbers of behaviors, exploiting positional distribution of agents, coping with a variety of control parameters, managing the generation of new agents, using the concept of velocity in optimization, and utilizing different types of exploitation (Hassanien & Emary, 2016). I mapped each of the listed behaviors to one or more aspects of self-managed teams.

Examining the applications mentioned indicates the value of how swarm intelligence simulation may present different approaches for various team functions such as decision-making. Mimicking intelligent swarms may increase team members' performance and output; self-managed team members can apply swarm intelligence when establishing approaches for team functions and decision-making processes. Table 2 shows how self-managed team members can apply swarm intelligence to areas of concern, as well as opportunities to enhance or improve team performance or outcomes. These areas underwent exploration and mapping as implementation strategies for self-managed teams in the following sections.

Table 2

Comparison of Intelligent Swarm Behaviors with Self-Managed Implementation Strategy

Intelligent swarm behavior	Self-managed team implementation strategy
Following an optimized solution to a problem	• Strategy selection • Find different methods to solve problems • Decision-making process • Progress update
Applying probability distributions	• Decision approach
Dealing with different number of behaviors used	• Dealing with personalities • Team norms and culture
Exploiting positional distribution of agents	• Using expertise • Training team members to get closer to each other
Dealing with a variety of control parameters	• Dealing with the complexity of models
Managing generation of new agents	• Onboarding members • New hires
Using the concept of velocity in optimization	• Coordination between members of the team
Utilizing different types of exploitation	• Market/external input/finding

Utilizing Intelligent Swarms

Many interdisciplinary studies have presented data on intelligent swarms, with each study expanding on one or a few of bioinspired processes or algorithms. Bats, fish, fireflies, cuckoos, bee colonies, wolves, and many other social beings collaborate to achieve complex goals. These social beings act in groups, swarms, or colonies that are a form of intelligence at large.

Biologists conduct field studies of intelligent swarm behaviors in long-term research studies, expedited with new findings made possible using the latest technologies, such as video analysis. Applied researchers use these findings in various forms, sometimes in simplified models that scholars in various fields can apply. For example, Luo, Xie, Huang, and Shan (2017) used a simple model of schools of fish, known as the artificial fish swarm algorithm (AFSA), to model a dispatching method for taxis. Karaboga et al. (2014) applied the behavior of bee colonies to a variety of applications for finding the optimum solution and performance increase. In the following sections, I will present such findings to articulate areas correlating with the application of intelligent swarms in self-managed teams.

Learning from bats. Bats use short signals in echolocation, their ability to use variable frequencies to find objects and prey. Through this signal, bats can measure distance, the target's orientation, and the type of prey and its speed. The complete logic and processes used by bats are extremely complicated. For that reason, researchers have simplified the behavior into algorithms. Yang (2010) presented an algorithm for bats that includes echolocation usage, how bats know the difference between food and other

objects, and usage of frequency, pulse emission rate, loudness, amplitude, and pulse rate to control parameters and adjust to the optimum positions. In accordance with this algorithm, the movement of a bat becomes a series of position adjustments toward its prey based on echolocation parameters until it achieves its goal. Luo, Zhou, Xie, Ma, and Li (2014) considered the continuous optimization nature of bat algorithm and proposed a discrete version to apply in situations when a constant or continuous survey of positions is not possible or cost-effective. This research is interesting in relation to decision-making processes, in that it allows for a variety of selection processes of permutations. In the proposed algorithm, the moving agent (bat) uses simple methods of swapping (between two possible new positions), inserting, and crossover to find the optimum solution by updating direction, the velocity of movement, and overall position of the goal.

Variations of bat algorithms are modeled for different situations, thus necessitation of exploration to find optimum versions for self-managed team application. Bats continuously seek the environment and adjust their courses based on updated locations of prey and other bats. The main differences between these variations are the frequency of the external checks and the periodic adjustments instead of the continuous natural model. One variation to note is the binary bat algorithm, proposed for improving feature selection by Nakamura et al. (2012). In this variation, used to optimize search frequency, bats use binary mechanisms to choose their next best positions.

Leaders setting up self-managed teams can apply bats' approaches to moving toward their goals in their decision-making processes. Bats live in large groups and use the same simple rules to move around and toward their prey. In a self-managed team,

each person should evaluate the choice between options (and, if possible, a binary selection between only two options). As all team members evaluate choices, they find the preferred option and approach a decision. Bats continuously use their method, but team members can discuss at intervals as they collect more information and move toward ideas presented by others; individuals can then consider final results to make the final decision.

Particle swarm optimization is a similar biomimicking pattern, presented by Kennedy (2011) as a simple algorithm that provides a method for simulating social behaviors. Inspired by the synchronous and choreographic moves of flocks of birds, particle swarm optimization searches for each bird's rules of movement. These rules allow birds to fly in mesmerizing coordination. In mapping the physical world to the social experience perspective, some of the boundaries of the cognitive or experimental variables merit reconsideration. This study does not present physical movement similarities but the beliefs and attitudes to conform with peers. The proposed particle swarm optimization presents the concept of "collision" differently from the physical world; two birds cannot occupy the same physical space, but people with different beliefs can. Particle swarm optimization presents the velocity of agents in swarms (team members reach a certain understanding at their own pace) as well as a stochastic variable (to provide reasons for randomness observed in social behavior) for faster approaches and better solutions.

To summarize the takeaways from bat algorithm, binary bat algorithm, and particle swarm optimization, self-managed team members should receive as much information as possible so they can evaluate various options. Team members must

receive encouragement to build their knowledge and take smaller steps to approach decisions, which indicates the realities of changing goals and ultimate goals in constant motion. Team members can see how others in similar positions moved forward. The key bat and bird biomimicking patterns include incremental knowledge-gaining, consultation with nearby team members, iterative evaluation of overall goals, and validation of the direction of thoughts and decision-making points.

Artificial fish swarm. Certain species of fish move together for food and protection. As in other swarms, fish do not have leaders, yet they act and work together as a unit. Scholars used the AFSA to simplify the complex behavior exhibited by fish in schools. AFSA is "a population-based evolutionary computing technique" that uses social behaviors of fish in schools (Hassanien & Emary, 2016, p. 17). The simplified version of AFSA provides easy rules that each fish uses to search, swarm, chase, and leap. The main defining element in this behavior is the scope of vision of every fish. If the vision is empty, the fish can do a random search and move to a new position. If the vision is crowded, the fish moves along a direction based on the positions of other fish in vision. If the vision is neither empty nor crowded, the fish can swarm or chase a better position. In swarm state, the direction is based on visible fish positions, and in chasing state, fish search the best position toward their desired directions.

AFSA presents an essential aspect of swarm intelligence application to the study of self-managed team members: different behavior based on the scope of vision. Many practical applications exist for the simple behavioral model presented in AFSA. Farzi (2009) provided a modified version of AFSA to optimize job scheduling in grid

computing. Team members can apply the concepts of visual fields to physical and cognitive teamwork, presenting cognitive visibility in the form of knowledge about a certain aspect of work that is not visible to others. Self-managed team members benefit from different field visions that include the perspectives of others in activities, including the decision-making process.

Rosenberg (2016) established UNU, an online platform that people can use to interact and solve problems as an artificial swarm intelligent unit. Individuals have used the platform to predict the outcomes of many social events, including sports, the person of the year, and directions of industry movements. Neurological brains and swarms, such as swarms of honeybees, have similar decision-making processes (Seeley, 2010). The process implemented in UNU includes integrating noisy inputs, weighing alternatives in real-time, and converging on decisions; individuals can use UNU as "agents" of swarms and work together to converge on solutions for various problems.

Self-managed team members can use AFSA and processes implemented in UNU to improve decision-making and integrate scopes of vision as model parameters. Team members should define simple functions so they can focus on what needs to be done, including work, research, learning and knowledge-building, and training. The team setup should provide adequate fields of vision for all team members to become direct contributors to all teamwork aspects.

Learning from fireflies. Fireflies exhibit swarm intelligence behaviors when they attract mates and prey or use their flashes as warning mechanisms (Hassanien & Emary, 2016). Fireflies produce short and rhythmic flashes that have various meanings

depending on their intensity and frequency. To understand the behavior of a firefly swarm, researchers consider a simplified artificial firefly. This simplified agent is unisex Attractiveness is defined by the brightness, which itself derives from the objective function. With these assumptions, researchers can design a simple algorithm to compare the position of each firefly to the next; if a firefly is positioned better (as known by the brightness of flashes the firefly produces), other fireflies will move toward the brighter one. Self-managed team members can use this behavior by offering their stances on a situation. Team members will observe and study other members' points of view and check the relative rational information to vote for another person. Once done, they will review the information and stances of others, eventually selecting the best stance.

Fireflies can naturally and artificially form multiple sub-swarms until they converge with others and move toward the optimum results, a process known as the parallel firefly algorithm. Subutic, Tuba, and Stanarevic (2012) introduced the concept by providing separate threads of fireflies. In their version of the algorithm, these sub-colonies run the algorithm on their separate threads and communicate by exchanging agents based on new populations. Subutic et al.'s (2012) showed faster and better results. Multiple groups of fireflies within a swarm are similar to groupthink. Leaders setting up self-managed teams should establish processes to avoid groupthink, but if groupthink still occurs, team members can work on parallel solutions and exchange information to find the best solution.

Firefly algorithm variations can be mixed and matched with the underlying problems at hand to solve a wide range of problems (Fister, Yang, & Fister, 2014).

Examples include using the firefly approach for business process optimization (Salomie, Chifu, Pop, & Suciu, 2012). Ochoa-Zezzatti, Hernández, and Ponce (2014) applied the algorithm to social project selection by finding the maximum output of a potential project based on the location of the initial point and how team members achieved results. In the same way, team members can use the firefly algorithm when choosing between available options given to limited resources (i.e., deciding between choices).

The firefly algorithm can be combined with stochastic modeling to generate further alternatives (Imanirad, Yeomans, & Yang, 2018). With this approach, researchers use a simulator to generate and evaluate potential alternatives. In the same way, team members can use the co-evaluation of fireflies to understand other members' perspectives, reach the best solution, and arrive at an agreement at the team level. Self-managed team members can derive simplified rules of conduct from firefly-inspired models for idea generation, decision-making processes, and optimizations.

Learning from wolves. Different species of wolves present various group behaviors, one being when wolves in the pack divide and separately search for prey. Tang, Fong, Yang, and Deb (2012) introduced the wolf search algorithm to simplify the movement of wolves toward prey. Self-managed team members can use this approach. When team members search for a solution, they can break the problem down into smaller sub-problems, with each member then working on a particular sub-problem. As individuals work on their assigned sub-problem, they keep an eye on others, trusting that team members are covering their particular space. When team members encounter issues, they can mark the challenge and find passage around it.

In wolf search algorithm, each wolf moves according to its optimized position. However, wolves also work together. The wolf pack algorithm presents this process (Wu & Zhang, 2014). The wolf pack algorithm shows how wolves collaborate based on their hierarchy in the pack and includes a hierarchy that starts with a lead wolf and elite scout wolves. When wolves find their prey, they communicate by calling the pack. Wolf pack algorithm uses this calling behavior. Wolves in wolf pack algorithm summon others when they find prey so that they can close on it faster and more effectively.

The difference between wolf search algorithm and wolf pack algorithm is the number of pursued goals. Self-managed team members can use wolf pack algorithm to scout a wide range of possibilities. Once team members discover traces of a better solution, they can use the calling behavior to summon others to evaluate the potential solution. Depending on the self-managed team's goals, members could be assigned to seek a solution or receive a sub-problem to solve. Once team members find a solution, they can call others to speed up problem resolution or consultation.

These approaches are applicable in hierarchical structures. A variation of wolf search approach used by gray wolves presents more roles within the hierarchy. Mirjalili, Mirjalili, and Lewis (2014) showed that hierarchy levels in swarm searchers indicate better results than existing organizational hierarchies. Self-managed team members can use these findings to facilitate the transition from a traditional hierarchy to a self-managed team while keeping a sense of central control suitable for larger organizations. Wolf search optimizations can provide team members with new methods for choosing the right issues to work on, and members can divide the problem into sub-problems so

members with more specialty in each area can lead exploration efforts and collaborate on the optimum solution (Hassanien & Emary, 2016).

Learning from ants. More than 12,000 ant species show behaviors that self-managed team members can use to improve problem-solving. Ants use pheromones to communicate with each other, as each leaves a trail of pheromones as it forages for food. Eventually, the shorter or more successful path to food receives more pheromones and becomes the preferred choice. Dorigo and Gambardella (1997) were among the first to demonstrate how individuals can use this behavior to solve optimization problems, such as the traveling salesman problem (choosing the shortest route to travel between a few destinations). The researchers presented a communication mechanism with decision-making and usage of experience. Self-managed team members can act as members of an ant colony by simulating the knowledge, experience, exploratory results, and lessons learned from past situations. Ants communicate their preferences after walking a passage; team members can use the same concept to propose an option or weigh in on a concept offered by others.

Dorigo and Stützle (2019) used applications of the ant colony optimization to solve scheduling problems, vehicle routing problems, and assignment problems (pairing items based on particular conditions and desired outcomes). Ant colony optimization approach uses two elements to determine the probability of a certain choice: accumulation of pheromones on each option and visibility of success. The result of the comparison between the ant colony optimization-based approach in solving selection decision-making processes and traditional approaches had over a 95% success rate

(Ghasab, Khamis, Mohammad, & Fariman, 2015). When self-managed team members reach a decision-making point or need to generate options, team members can use lessons learned and experience to make a selection in the same way ant colony optimization shows passage preference due to pheromone accumulation. Ants' visibility of their surroundings translates into organizational knowledge, personal knowledge, and knowledge gained during the performance of the current or recent tasks.

Recent studies showed that ants use different types of pheromones that are produced by various glands, and each pheromone lasts for a specific time (Heyman, Shental, Brandis, Hefetz, & Feinerman, 2017). Ants use their pheromones to expand their communication to include information about currently active trails and depleting food sources. Forager ants use short-lasting pheromones when they want to attract sufficient nest-mates to collect prey, and use the long-lasting pheromone to lead other ants to longer-lasting food sources, such as a patch of desirable plants. For example, short-lived pharaoh ant pheromones last 20 minutes, and long-lasting pheromones can last for days. Ants use other pheromones as alarm mechanisms to indicate the urgency of decision-making. Ants use this mechanism to choose the best path based on this signal or similar ones or continue based on their knowledge (e.g., to explore other passages). Self-managed team members can replicate this method by allowing team members to vote on particular options, as well as assigning a higher and lower priority on options.

Researchers expanded the ant colony optimization approach for image processing and edge detection. Scholars can use ant colony algorithms to understand the overall view of a picture (e.g., to mark the boundaries of foraging areas). This process is based on

optimal foraging theory, with subsequent adaptation to information foraging theory (Pirolli & Card, 1999). In information foraging theory, individuals display the same behaviors as animal foragers when they look for information online (Drias & Pasi, 2016). To support this theory, Drias and Pasi (2016) used ant colony optimization to indicate the similarity of web surfers and ant foraging. They applied ant colony optimization to a real website with search words and quickly found relevant results. In this way, self-managed teams can use ant colony optimization to gain an understanding of the full picture, as in why they are working on various projects and how do they fit in overall goals and objectives, thus establishing a general sense of cohesiveness to achieve all team targets while avoiding pitfalls and wandering among false targets.

Decision-making in honeybees. Honeybees display behaviors that self-managed team members can apply when dealing with challenges. I focused on two decision-making behaviors and examined fieldwork and various models of how bees perform their tasks. Bees use the first behavior, foraging behavior, to select areas around their nests for maximum efficiency. The second behavior is the process of selecting a new nest.

Foraging behavior is a critical bee swarm function. Scholars have widely studied bee swarm functions and have utilized the resulting models in various applications. Artificial bee colony algorithms present data on three types of bees in the colony: scouts, foragers, and onlookers. Scouts leave the hive and locate sources of food. Experienced foragers combine historical information of the location and quality of food sources (cognitive knowledge) with scouts' input (social knowledge). Onlooker bees use elevated social knowledge (after experienced foragers combine social knowledge with cognitive

knowledge) to consider their next trip (Hassanien & Emary, 2016). Artificial bee colony algorithms have many variations that present wider potential applications, including software engineering, telecommunication, mechanical and civil engineering, data mining, image processing, and industrial engineering (Karaboga et al., 2014).

Experienced bees use a simple version of the algorithm to evaluate their cognitive and social knowledge in each decision-making round. Onlooker bees and scouts use the algorithm to choose a destination for food collection or look for prospect locations. Li, Xie, Pan, and Wang (2011) provided a hybrid version of an artificial bee colony. The researchers sought to solve job scheduling problems; however, they found important enhancements that self-managed team members can consider. First, Li et al. (2011) added multiple objectives to the algorithm. Second, they modified the approach of scout division into two groups. Scouts in one group advocate for the locations discovered up to that point, and scouts in the other group continue searching for potentially better locations. Self-managed team members can use this process to start exploiting solutions along with further exploration, depending on the underlying problem at hand. The proposed hybrid approach is based on improving the search algorithm to local search improvement (an optimized local search where members prioritize possible neighboring solutions), thus maintaining previous acceptable solutions while continuing the search.

Honeybees go through a decision-making process when they are ready to choose a new nest. The oldest and most experienced scouts (accounting for 300 to 500 of every 10,000 bees in an average colony) that had the role of foraging up to that point are dispatched from the hive to look for new nest locations. Seeley (2010) confirmed that

scouts mainly investigate the overall size, entrance size, and direction of the potential nest's opening (north is preferable) in their search. Scouts return to the colony and present their findings in a waggle dance, encoding the position of the potential new location in their movement. For example, one second of the dance is equivalent to one kilometer. Researchers measure these and other movements with the latest technologies. Scouts may repeat this advertising movement every 30 minutes, with each scout promotes the location found based on observations. After a few days, scouts limit their dances to fewer places, and on moving day, all bees choose the winning location. Nearly always, bees reach a consensus, but division can also occur, which normally causes further deliberation.

Bees essentially face a choice of "best of *n*." Humans rarely rely on consensus (jury members are among the few who do) and make decisions based on majority or adversary democracy. Although scouts do not visit all the potential nest options presented, they do visit certain sites and may choose to continue advertising their original site or move to support another. Seeley (2010) stated that scouts communicate the quality of the new nest through the strength of their dances (higher duration and frequency). Scouts follow a "retire and rest" pattern after presenting their findings and visiting other potential nest sites. Unlike humans, bees stop pushing for their options when other bees discover new, better ideas.

Seeley (2010) also demonstrated that bees make decisions not on consensus but quorum. He placed multiple nests close to each other. Although bees in the swarm took longer to decide on a nest, in the end, they chose one and all bees moved in. Bees allow

for a balance between speed and accuracy. Foss (2016) distinguished this as a survival matter for bees in the swarm, as they have limited time and resources.

Bees also display directional behavior when they start executing their decision. By the time they leave for the new nest, less than four percent of the bees know the location of the new nest. Seeley, Visscher, and Passino (2006) used advanced video techniques to prove that scouts quickly and repeatedly move near the top of the swarm as fast as 34 kilometers per hour. Scouts then slowly fly back to the swarm and repeat the routine, resembling an arrow to point out the way to others.

Seeley (2010) tried to apply honeybee swarm behavior and learned approaches to the decision-making process of a university department. When deciding on a topic, members of department must begin by creating a sense of interest with respect (everyone's view is important and counts). Then, the university department leads must minimize leaders' influence, adjusting the role to be as impartial as possible. Next, they must cultivate various solutions by asking for independent exploratory work. Next, university leads should aggregate group knowledge so all members can decide on a solution or set of solutions. Finally, they use quorum responses for accuracy balance, cost, and speed. Implementing this process can be via different approaches, such as polls.

Self-managed team members can also learn from how bees explore options. Self-managed team members can only apply bee behavior when making decisions and when choosing the team's next important task. Team members choose the right next step while seeking the next activities. Although bees work as a swarm and follow the next best move, they benefit from the skills and experience that each bee brings to the situation.

The main decision-making difference between bees and humans is how bees use their experience (cognitive knowledge) but update their points of view when they learn about the latest food or nesting options (social knowledge). Bees change their options without resistance by evaluating the reality of options and newly acquired knowledge. Thus, team members with different personalities should learn to accept others and what they can bring to the team. Finally, bees' constant lookout for better options shows how self-managed teams and organization-wide employees should continuously search for improvement to move toward becoming a learning organization.

Learning from cuckoo search. Cuckoos lay their eggs in the nests of other species. Some species of cuckoos have even adopted the shape, color, and pattern of their preferred hosts' eggs. Cuckoos search nearby areas but fly far to search other neighborhoods, increasing the possibility of finding a suitable nest. Yang and Deb (2009) simplified the behavior of cuckoo species into the artificial cuckoo search. Cuckoo search presents a wider scope of neighborhood searches than other models and expands cuckoos' neighborhood searches to other segments of probabilities, then selecting between older nests and newly found ones. To find their optimum nests, cuckoos use levy flights, taking longer steps at random to cover wider areas and quickly find new opportunities.

Researchers have used cuckoo search in many applications, including image processing, neural network training, spam detection, and feature selection (Hassanien & Emary, 2016; Yang & Deb, 2014). The egg in cuckoo search is the equivalent of a solution to a problem. If the hosting bird discovers the cuckoo's egg, it will discard the

egg (i.e., the solution is not the best option). Researchers used a random probability in the original cuckoo search to simulate discovery of the egg, but Bulatović, Bošković, Savković, and Gašić (2014) improved cuckoo search function to include more parameters to control the potential success of the solution.

There is no known standard approach for team members to search for solutions due to the nature of problem-solving. However, self-managed team members should be equipped with such approaches so other members can achieve their objectives. In other words, team members should use cuckoo search to pursue options and solutions instead of searching for options and solutions randomly. Self-managed team members can use how cuckoos choose a nest (a solution) with the highest prospect of success. Team members need first to identify the parameters of the problem. Then, each team member should attempt to solve the problem, which may involve choosing priority work features (or any other problems). Team members then explore the advantages or disadvantages of the potential solution. After team members examine the potential solution in a range of parameters, they can dramatically change the parameters (levy flight) to find potential solutions in that vicinity. Team members compare their initial solutions with new potential solutions, refine the active solution set, and continue until they present their findings. Then, team members can compare and contrast their findings with each other.

Decision-Making in Self-Managed Teams Using Biomimicking

Since humans evolved in groups, they are familiar with living with others and making decisions together; however, inefficiencies in group decision-making cause loss of opportunities. Considering group decision deficiencies presented by humans' cognitive

minds, Tindale and Kameda (2017) recommended comparative research between humans and social animals. Tindale and Kameda evaluated how humans use collective wisdom and social sharing to modify group behavior and avoid missed opportunities in the forms of motivational or coordination losses common in human groups but not in social beings like bees. In this study, I outline the learned behavior of social beings to support a better understanding of self-managed teams' setup and functions with a focus on the decision-making process.

The people close to an underlying subject can make better decisions about the subject. Accuracy diminishes when larger groups of people who may not be as close to the problem get involved. People in swarms (with closed feedback loops) act better and make more accurate predictions than people in larger crowds (Rosenberg, Baltaxe, & Pescetelli, 2016). Team members can find better solutions than when members higher in the hierarchy dictate decisions from outside the team.

As noted in the review of simplified processes used by social beings, team members can apply basic rules and mechanisms to address even the most complicated problems. For example, bats use echolocation to identify the locations of their prey and other bats while avoiding various obstacles. Bats make decisions and perform corrective actions while using echolocation. This process presents highly optimized decision-making routines that self-managed team members can use for various selections and decisions. Taha and Tang (2013) presented a new version of the bat algorithm for attribute reduction. Attribute reduction is the process of choosing an optimal subset of attributes to achieve a given result. Attribute reduction techniques are useful in pattern

recognition: I use these techniques in my study to improve decision-making processes in two ways: first by helping self-managed team members choose between available options based on known problem attributes, and second by helping self-managed team members recognize selection parameter patterns and providing a higher-level view that otherwise might be hard to distinguish.

Scholars have used swarm intelligence and biomimicking in different areas of science and for different applications. Rosenberg, Pescetelli, and Willcox (2017) combined swarm intelligence and decision-making, providing an online system for employees in financial groups who made financial predictions. The increased performance of these predictions using swarm intelligence indicated two main points aligned with my study. First, members of intelligent swarms help each member to make better predictions under uncertainty, and second, team members can use simple models, such as online collaboration systems, to interact and share key data and increase everyone's success rate. Sharing personal points of view for prediction aggregation is a step toward group decision-making and can be a base for an approach for self-managed team decisions.

Humans think and behave differently from nonhuman agents in a swarm. Marshall et al. (2017) provided a model that includes behavioral differences, arguing that individual behavior differences can and should be included in intelligent swarm models, even for animals. Marshall et al. exemplified groups of birds such as green woodhoopoes, meerkats, and dwarf mongooses to present behaviors that indicate efforts to include all members in decision-making but pay more attention to certain members. Marshall et al.

applied this concept to develop a model based on members' confidence levels, positing that the outcomes of such models are better than models that do not indicate confidence levels. This is a great entry point to include higher levels of humans' cognitive minds in this study. Given differences between team members' personalities, backgrounds, and overall frames of reference, human team members need more complicated consideration when they choose between available options and decision-making processes. The inclusion of behavior differences will provide leaders with opportunities to use swarm intelligence to come up with better decision-making models.

Self-Managed Team Implementation Strategies Using Biomimicking and Swarm Intelligence

Learning from bats that move towards their prey among many other bats by constantly surveying the environment and positions of others and their prey and deciding the next move based on that, led to change awareness and communications behavior, importance to decision-making in self-managed teams, and the need for consultation with team members. Learning from fish swarms, provided the behavior and need for having overview vision and importance of goal-orientation. Behavior of fireflies in alarming others about a desirable or unwanted situation led to necessity of subgrouping and importance of generating more alternatives for decision-making. Learning from wolves can help leaders of organization to implement self-managed teams within their hierarchies. Using the simple rules from ant colonies, self managed teams can learn how to stay on course and be cohesive within the teams. Finally, decision-making in honeybees when moving to a new nest can be mapped to a guide for making complicated

decision, providing decision behaviors to investigate options, importance of getting feedbacks from all team members, dividing teams into smaller groups, and validate the decisions by constantly evaluating the changes and surroundings.

For leaders to set up their teams based on the learned disciplines of nonhuman social beings and intelligent swarms, members should exhibit the following behaviors:

- Understand the overall team function, goals, and required tasks.
- Respond to internal and external changes collectively.
- Understand and plan for emergencies.
- Understand the equality of all members and feel comfortable opining in team activities.
- Know about end goals and periodically check for internal or external system changes. Team members strive to stay in alignment with other team members. In this way, team members can make small corrections to stay on track.
- Understand that, due to different frames of reference, certain team members may need more time to reach the same level of understanding. They should collaborate to reach the same degree of understanding or move in the same direction in thought processes. Team members with closer points of view and those with different ideas should consult with each other frequently.
- Iteratively share information and communicate changes.
- Because team members may have different perspectives, members should constantly transfer knowledge to ensure information distribution.

- Consider team members' experience, organizational knowledge, and lessons learned from past tasks and prioritize and validate options presented through experience.

In addition, team members must follow a series of steps in making a decision. These are:

- Break down the problem into smaller sub-problems with few and preferably binary options and discuss the best choice with all team members. Team members will continue to solve other problems until they find a clear solution to the main problem.
- Communicate alternatives and discuss choices iteratively to reach a stronger acceptance of the decision.
- Discover and present potential solutions, and invite team members to explore solutions. Team members should advocate for the strongest solutions, regardless of who first presented them, checking other solutions with open minds.
- Divide into sub-groups to find different potential solutions if team members cannot find clear alternatives. Team members exchange sub-groups to trigger innovation.
- Opine on selected solutions and change parameters to discover a potential stronger solution variation.
- Once team members select a solution, they continue to explain the approach to others who do not understand or were not able to take part in the discussions for any reason.

Gap in the Literature

Scholars and industry leaders have studied self-managed teams from various perspectives; however, there is a general gap in the literature on an inclusive self-managed team implementation for decision-making. Liff and Gustavson (2016) were among the few researchers who provided guidelines for the implementation of self-managed teams; however, these high-level guidelines do not provide solutions to the challenges that leaders setting up self-managed teams need to address. Researchers studied both successful and struggling self-managed teams to discover how to address self-managed team challenges. Findings generally presented only one or a few self-management aspects, such as the role of goal orientation, measurement on empowerment, humility, stewardship, and accountability, communication, team dynamics, conflicts, and interpersonal relationships (Lee & Paunova, 2017; Sousa & Van Dierendonck, 2016; Wageman, 2001). There is a gap in the literature on the fundamental differences of decision-making between traditional and self-managed teams to provide an approach that organizational leaders can use to set up self-managed teams for success.

The expected implementation process resolves the lack of a decision-maker in self-managed teams. Aspects that have effects on decision-making processes in self-managed teams include information availability, team member participation, addressing the roles of leaders and facilitators, and division of design and technical work (Beersma et al., 2016; Halvorsen & Sarangi, 2015; Kudaravalli et al., 2017). There is a gap in the literature on inclusive decision-making approaches that self-managed team members can

use to address significant challenges such as groupthink, lack of synergy, and organizational goal alignment.

Summary and Conclusions

The purpose of this study was to describe common decision-making strategies for self-managed teams as experienced by team members using behaviors exhibited in intelligent swarms in an IT company in Toronto, Ontario. In this chapter, I reviewed the literature on self-managed teams and provided high-level perspectives on how self-managed team members work as well as their challenges, specifically when making decisions. I also evaluated behaviors of intelligent swarms, depicted how certain species of social beings work without leaders to achieve optimum results, and focused on how certain social beings make decisions and how self-managed team members can use these organic behaviors.

Self-managed team implementation requires devising new approaches to problem-solving, revising existing activities, and inventing new ways of doing activities. Some researchers, like Liff and Gustavson (2016), provided guidelines and views on how to accomplish this. Few other researchers noted in this chapter measured the success levels of self-managed teams using a few specific parameters. The literature review indicates a gap in research on overall views and frameworks that self-managed team members can use to address various aspects of their teams. Tindale and Kameda (2017) recommended learning from the collective wisdom and experiences of nonhuman social beings. In their view, social beings use natural models to minimize opportunity loss. I compiled a set of behaviors to simulate how nonhuman social beings execute leaderless collaboration in

nature. There is a gap in the literature on the effectiveness of such approaches in self-managed team implementation strategies, including decision-making. A qualitative multiple-case study allowed me to research this gap. Chapter 3 contains the methodological aspects of the research and the rationale for the qualitative descriptive multiple case study approach.

Chapter 3: Research Method

The purpose of this qualitative descriptive multiple case study was to describe common decision-making strategies for self-managed teams as experienced by team members using behaviors exhibited in intelligent swarms in an IT company in Toronto, Ontario. The findings of this study provide a new approach to fill the research gap on self-managed team implementation strategies that include the application of swarm intelligence. Chapter 3 includes the rationale of this study's approach, as well as the rationale for the method and selection of design, description of the researcher's role, data collection plan, and data analysis plan. This chapter also provides information on the procedures and trustworthiness of the study.

Research Question

RQ: What are the common decision-making strategies for self-managed teams as experienced by team members using behaviors exhibited in intelligent swarms in an IT company in Toronto, Ontario?

Research Method and Rationale

I used a qualitative research method for this study. Greek philosophers such as Protagoras, Plato, and Aristotle used qualitative inquiry to find strategies and methods to seek a common perception among different perspectives (Duemer, 2007). Qualitative inquiry provides opportunities to learn the meanings of human experiences, study how things work, capture peoples' perceptions and experiences, understand the context, identify unanticipated consequences, and, specific to the case study design, discover patterns and themes across cases (Patton, 2015). These align with the current study's

purpose, which was to describe common decision-making strategies for self-managed teams as described by team members using behaviors exhibited in intelligent swarms. Qualitative inquiry provides techniques and designs for the study of complicated topics with unknown variables and parameters. Scholars can use the qualitative approach for in-depth studies on complex phenomena (Harrison et al., 2017). A qualitative research method was appropriate for the current study and for conducting interviews on self-managed team members to gain insights into their experiences. These insights were used to address the research question and fill the gap in the current literature.

A quantitative research method is appropriate for research with a problem expressed through measurable variables, allowing for the evaluation and testing of relationships between variables (see Patton, 2015). Quantitative researchers evaluate and test variables by administering surveys or designing and performing experiments on measurable samples to interpret or predict the behavior of a larger population (Frankfort-Nachmias & Nachmias, 2008). Because I did not intend to measure variables and their relationships, a quantitative inquiry was not suitable for the study. The mixed-methods approach incorporates both qualitative and quantitative methods; as a quantitative methodology was inappropriate for this study, so, too, was a mixed-methods approach.

Research Design and Rationale

This study was designed around a descriptive multiple case study design. Researchers use case studies to derive an in-depth understanding of a single case or a small number of cases (Yin, 2012). The evidence from multiple case study research is considered more compelling (Yin, 2018, p. 92) as they replicate the same research design

(Yin, 2018, p. 93). A multiple case study contains additional data and produces greater confidence in study findings.

A descriptive multiple case study was appropriate for my research, as each case provided a unique perspective on how team members described their teamwork experiences. Multiple case studies enable scholars to explore numerous evidence sources through replication (Zainal, 2007). If the results are similar or replicated, the findings have higher reliability (Baxter & Jack, 2008). The case study design was suitable for the current study since each team's context, along with the members' underlying work, was relevant to the study.

Besides case studies, other qualitative research designs include narrative, grounded theory, and phenomenology. Narrative inquiry presents lived experiences as sources of understanding for experiences through the lens of a narrative (Clandinin, 2013). In narrative design, scholars consider participants' experiences to extract a general meaning. This approach was not suitable for the current study, as narrative design lacked narrative integration into team members' perspectives.

Grounded theory is based on change and control (Corbin & Strauss, 1990). Grounded theory was not suitable for the current study, as scholars who use grounded theory code rounds of collected data to make a theory. In such cases, the focus is on creating a new theory to understand the participants' perceptions.

Scholars use phenomenology to search for the meanings of lived experiences from the perspectives of a person or a group of people (Patton, 2015). Phenomenology was not suited for the current study since it is a means to express the experience of

members. The goal of the current study was to present participants' lived experience within the boundaries of each team, as encapsulated in each case study over a determined period of team activity participation.

Role of the Researcher

The researcher has a vital part in qualitative studies, having a role as observer, participant, or a combination thereof. Each of these roles may present bias or emotional impact (Mitchell, 2011). I acted as an interviewer in this study. I conducted 14 semi structured interviews with each member of each self-managed team to collect information to answer the study's main research question. I also observed the interviewee's behavior and took field notes. These interviews were with self-managed team members; the teams have four to 10 members depending on their latest projects. I encapsulated each team in a separate case study. I audio-recorded interviews along with my notes on each interview and documented additional participant feedback during each interview, as was expected from open-ended interview questions. I then transcribed the interviews. This process will receive further elaboration later in this chapter.

To triangulate data, I collected recorded organizational information, such as project metrics, budget forecasts and actuals, and other performance indicators that indicated the success of team members' projects as secondary data. This information, together with my field notes, provided themes that I used to organize information to answer the research question.

The researcher's bias may occur during information collection. Bias is an intervening factor of the interview process, along with a lack of trust, knowledge

construction, and language ambiguity (Myers & Neuman, 2007). Shento (2004) proposed that scholars can use triangulation to reduce bias and avoid or limit the admission of their beliefs and assumptions. Researchers can limit the effects of bias by recognizing and documenting their shortcomings only to set them aside, in a process known as bracketing (Wadams & Park, 2018). I maintained a journal of hand coding with field notes to reflect on personal perspectives. I had also made sure the design of the interview questions was open-ended to shield participants from my potential bias. As an external researcher on the company and self-managed teams, I did not have potential interferences or positions of power over the participants. I used journals (bracketing) to reduce bias and limit the impact of bias on data collection.

Methodology

This section contains my approaches for information collection and data analysis, including the participant selection process, instrumentation, and data analysis procedures. This section also contains issues of trustworthiness, credibility and dependability, and confirmability. I will also describe the implementation of the descriptive multiple case study to address the research question.

Participant Selection Logic

The target population consisted of self-managed team members in the IT industry in Toronto, Ontario. I collected data by conducting interviews in a company where self-managed team members develop products. I selected three teams with four to 10 team members for the interviews. The team size and the number of participants depended on the specific project or product the team members were handling. By interviewing

members from three self-managed teams, I was able to triangulate self-managed team members' description of success in conjunction with team members' experiences, knowledge, and maturity of behavioral patterns and processes.

As members of self-managed teams, participants have the direct experience required for the study. Participants had different knowledge backgrounds, work experience, and self-management experiences. These potential differences provided a wider range of input and enriched each team's case study. I made sure participants had completed one cycle of work, such as a project or product release, to describe their experiences of working in self-managed teams. Participants also were able to judge the success or failure of established self-managed team implementation strategies.

There were three cases in this multiple case study, with each providing the descriptions of members of one team. The number of team members determined the number of interviews and study participants. I asked the company's leader to solicit participants after receiving approval from the Walden University Institutional Review Board (IRB).

Scholars can use qualitative studies to make credible and reliable conclusions with relatively small sample sizes (Patton, 2015). Factors such as research type, sample pool limitations, and availability dictate the size of the sample (Baker, Edwards, & Doidge, 2012). Mason (2010) compared scholars and concluded that most qualitative studies reach saturation with a sample size of 12 participants. I requested to study teams of near or equal size. The project size and product release priorities indicated the team size. Studied teams contained between four to 10 people, so as expected, I interviewed 14

(originally anticipated between 12 to 15) participants across the three cases, which was adequate for reaching data saturation in a qualitative inquiry.

Participant recruitment. I used purposeful sampling (see Patton, 2015) from three teams provided by the participating organization's leader to ensure the quality of data collection. I had verbal approval for interviewing self-managed team members. Per IRB guidelines, I provided a consent agreement that included the intent of the study and the request for written approval of the organization's leader. Each participant received a separate consent form in accordance with IRB guidelines.

Instrumentation

I conducted interviews and performed the role of primary instrumentation for the current study. I asked open-ended interview questions to allow participants to present their perspectives. I refrained from biases and limitations by asking open-ended questions that present opportunities to frame feedback, enrich participant input, allow wider and more conclusive themes, and expand input through follow-up questions.

Interview protocol. I used an interview protocol to guide each interview, serving as the data collection instrument for this study (see Appendix A). Guidelines for proper interview protocols include relativity of questions to the topic and having a base in research, scripts to start and finish, starting with simpler questions, proper duration, and a follow-up opportunity (Jacob & Furgeson, 2012). Participants were familiar with the process, as they had provided their consent before the interviews. During the interviews, I reconfirmed their approval for video recording. I also took notes during the interviews. Once the transcript was ready, I asked the participant to review the transcript to ensure

accuracy. The section “Participation and Data Collection Procedures” contains a full description of this process.

Fieldnotes. Field notes are the researcher’s written observations during the interviews and a source of increasing the credibility of the research (see Patton, 2015). I took field notes during the interviews to document nonverbal actions and communications. These notes included my observations, follow-up questions, clarifications, and other journal entries. I was able to use the field notes to enrich the contents and complete the interview context.

Organizational records. Following official organizational consent and before the interviews, I requested various organizational records such as product enhancement records, project metrics like budget forecast and actuals, performance indicators, and project/product closing reports for triangulation purposes. These records included status updates, decision logs, and success metrics. I analyzed the results of aspects of teamwork with the provided feedback.

The interview questions were designed based on the literature review. The interview questions presented teamwork structures within self-managed teams and provided opportunities for participants to describe their experiences of working in self-managed teams and self-managed team implementation strategies, with a focus on decision-making procedures. I had vetted and revised the interview questions to align with the purpose of the research, to expand on theories of social choice and sociobiology, and to address the research question. I made multiple revisions to the interview questions

to appropriately narrow the field while maintaining the flexibility and open-ended nature of the questions.

Procedures for Recruitment

I chose the IT industry for the study due to the fast nature and short cycles of work optimized with high frequencies and low costs. Finding the right participants is an important step in the sampling process that includes identifying the population, determining the sample size, devising sampling strategies, and sample sourcing (Robinson, 2014). The leaders of the company in this multiple case study are constantly searching to improve the throughput of their teams; I studied the team members of the introduced teams in this study. The members chose to participate in the study. I expected that participating in such a study was the right motivation for participation.

Participation and Data Collection Procedures

I was the primary instrument of data collection by conducting the interviews. I used the documented interview protocol (see Appendix A) to inquire about the participants' experiences. I conducted one-on-one interviews at the participants' company. I video-record interviews to facilitate accurate transcripts and focus on all interview aspects, with subsequent transcription to prepare data for analysis. Participants received a copy of the transcript of their interviews to review and provide feedback.

Participants signed and returned the consent forms before their interviews. Interviews were planned to take place over three weeks to ensure participant availability; each interview lasted approximately 1 hour. I communicated via e-mail before each interview. I assured participants before and during their interviews that I intended to use

their responses only for the research and that I would follow all privacy and confidentiality principles.

After completing the interview, I communicated to participants that they would receive copies of their transcripts within 72 hours, which they could review and revise as needed. I asked for an acknowledgment within 48 hours of receiving the transcript. I stated in the document and in the communication that if I did not receive feedback within a week, I would assume they have reviewed and agreed with the transcript. If the transcript required revision, I applied the requested edits and returned for the final review. After that, and in the case of further required edits, I would ask for a telephone conversation to finalize the document. The interview protocol contained follow-up procedures. I made sure that the majority of team members had agreed to participate before starting the interviews. If the majority was not achieved, I had planned to ask for another team or followed up to rectify the potential issue.

Data Analysis Plan

I analyzed the data collected during the semi structured interviews, transcripts, field notes, and supporting organizational feedback. During data analysis, I structured the collected data into initial categories and themes in alignment with the research question. I then coded the data to deduce the final themes and patterns.

Using inductive analysis, I searched the data for patterns and themes without preconceived analytical categories and identified emerging patterns as indicated by Patton (2015). I used the emergent patterns to categorize and code data that indicated key

points and challenges of self-managed team implementation; then, I framed similarities between the collected data and biomimicking behaviors.

I structured the collected data to address the research question. After the initial reviews, I used tools such as Excel to organize the transcripts' data. After examining tools like Atlas.ti, I decided to manually code and analyze data to ensure I can include my field notes and the results of my follow-up questions. Coding includes looking for related words or phrases that indicate a pattern. After this initial coding, I reviewed all the transcripts using manual coding to recognize and mark themes and patterns. Marked themes and patterns were used along with biomimicking behaviors to establish an understanding of self-managed team implementation strategies as well as potential improvements. I reviewed the discrepant data and explained them accordingly.

Issues of Trustworthiness

Qualitative studies have a similar pattern to other methodologies for trustworthiness. Credibility, transferability, dependability, and confirmability are elements of trustworthiness equivalent to internal validity, external validity, reliability, and objectivity in quantitative research (Ellis, 2019). I explain how I addressed these aspects of the current study in the following sections.

Credibility

To ensure research credibility, I used various strategies, including triangulation, member checks, and reflexivity. Triangulation is the process of using multiple data sources to check the research process. Interview transcripts were the main data source in the current study. I used field notes and organizational documents such as product

releases, project summary reports, and closing documents to further define themes and validate analysis approaches relevant to the research question. Participants provided feedback in member checks. I ensured that participants received the transcripts of their interviews. Participants reviewed their transcripts to ensure their answers to the interview questions had been captured properly.

Because the researcher is the primary data collection instrument in qualitative research, staying unbiased is challenging. Reflexivity is the process of identifying biases by the researcher and discovering subjectivities through the discovery process (Karagiozis, 2018). I journaled and documented narratives during interviews and analyses to ensure I understood my subjectivity, thus limiting the influence of personal biases.

Transferability

Scholars extend the result of a study to other cases, people, institutions, or times with transferability (Morse, 2015). The transferability of case studies comes from theory and not populations (Yin, 1994). I provided a thick description containing codes, patterns, and observed themes while analyzing participants' responses to allow for future application of the study's results to similar settings and ensure that the findings were of value to researchers in the interdisciplinary fields of management and biomimicking. Conducting multiple cases provided wider perspectives in addressing the research question. Participants also had different frames of reference and experiences, thus leading to a proper level of transferability.

Dependability

The context of qualitative research changes constantly. Dependability in qualitative research is similar to reliability in other methods, requiring the researcher to describe environmental changes (Ellis, 2019). I used open-ended interview questions and ensure that responses presented the evolving nature of teamwork to ensure dependability. I also kept journals to record audit trails and field notes throughout the data collection and analysis stages. Validating the transcripts with members of teams also increased the dependability.

Confirmability

Confirmability means preventing bias and subjective research elements (such as the researcher or participants) from affecting the research process. Quality researchers are inductive, starting from a neutral premise and allowing the findings to emerge without assumptions (Ellis, 2019). The journals used in the research was reflexive to minimize bias. During the interview process, I did not indicate my personal preferences through question content and structure, body language, or implied verbal and nonverbal cues.

Ethical Procedures

IRB approval was necessary before I could begin the participant recruitment process. After I acquired IRB approval, I solicited participants and provided them with consent forms. Consent forms included the purpose of the research as well as privacy and confidentiality guidelines and assurances.

Participants' voluntary participation and right to decline to participate also appeared in the consent form, as the procedures for data protection. I followed the

interview protocol in conducting interviews, which took place in neutral and safe environments. Each participant received a copy of the interview transcript and had the opportunity to review the transcript for accuracy. The data collection was not a conflict of interest, as participants were not affected by the results in any form. I did not have any relationships with the participants, so there were not any power differentials. Due to the nature of the study in the self-management field, incentives are unnecessary. I was the sole person with access to all the collected data, and I used the utmost caution in protecting the information. Five years after the study's completion, I will destroy, delete, and shred all the data, paperwork, and recordings in accordance with Walden University's requirements.

Summary

In this chapter, I provided an overview of the study's method and design, including the rationale for the multiple case study, the qualitative nature of the study, and the constructs to address the central research question. This chapter also provided support for various research aspects, including the researcher's role, data collection plan, data analysis plan, and aspects of trustworthiness. Chapter 3 also included the participant interview procedures and the instrumentation for data collection. The data analysis and findings from this study provide a better understanding of self-managed team implementation strategies that indicate higher organizational performance.

Chapter 4: Results

The purpose of this multiple case study was to describe common decision-making strategies for self-managed teams as experienced by team members using behaviors exhibited in intelligent swarms. A descriptive multiple case study was appropriate for the research as I wanted to gain a direct description of the experience of working in self-managed teams as provided by the team members. Scholars use multiple case studies to explore various evidence sources through replication (Zainal, 2007). Each case provided a different set of viewpoints through differences in interactions, communications, and team dynamics.

The descriptive multiple case approach aligned with the study's purpose to gain direct experience of participants who were all experienced team members in self-managed teams. I was able to gain knowledge of specific implementation of self-managed teams and their decision-making process in the context of the same company and understand the implementation of a self-managed team in an IT company in a location with a fast-changing environment. I was also able to compare patterns between self-managed teams and the behavior of social beings, as observed in intelligent swarms.

In alignment with the purpose, the following research question guided the multiple case study: What are the common decision-making strategies for self-managed teams as experienced by team members using behaviors exhibited in intelligent swarms in an IT company in Toronto, Ontario? This chapter contains details about the research, participants, data collection procedure, and parameters such as the interview process. The

data analysis section entails the approach and steps taken to code and categorize data into themes and patterns. This chapter also includes the results of the data analysis.

Research Setting

The participating company has implemented self-managed teams over the last couple of years. Over this period, multiple teams have been implemented in different product groups to function as self-managed teams. The products included new hardware and software systems. Through coordination with one of the product development leaders, potential participants from three different product teams received invitations to participate in the research. After consenting to participate, interviews were arranged and conducted via video conferencing.

The data collection instrument was a semi structured interview with three sections. The first section with six questions was designed to establish the experience and understanding of the participants on self-managed teams. The second section consisted of three questions to have participants describe their experience of working in their self-managed team setting. With four questions, the last section was used to make inquiries about decision-making processes within the self-managed team. The questions were aligned with successful collaboration patterns of behavior developed in the conceptual framework. These questions were also based on observation of a self-managed team setting that exhibited a team level wisdom (Katzenbach & Smith, 2015) and social beings exhibiting swarm intelligence (Ismail et al., 2015).

I did not collect any demographic information about the participating company in alignment with the research method and approach. The interview questions were not

about organizational conditions that might have affected participants during the interview process. As such, I do not have any information about any significant event or change in the participating company or participants that may have affected the interviews' responses.

Demographics

In a case study research, the ratio of the number of variables to the number of data points is high, as contextual differences will need to be understood (Yin, 2012). Each Participant in the study had to fulfill the following criteria: having worked in the participating company in one of the three teams considered for each case of the multiple case study and having completed at least one working cycle, such as a project, product feature, or enhancement. By fulfilling the first criterion, participants would have worked in a self-managed team setting in the company. With the second criterion, participants would have gone through a complete experience and seen the result of their work collaborations and decisions.

Participants only received the initial invitation if assigned to work in one of the teams considered in the multiple case study. All participants have been working in their current teams at the time of the interview for at least 6 months, which meant that they all fulfilled the first criterion. The second criterion was validated by a question about their experience working in a self-managed team during the interview. The feedback indicated that they all had completed multiple work cycles. The average number of projects and features each team goes through depends on complexity and size. Still, each participant has completed at least five major projects, product enhancement, or a unit of work. In

summary, all participants fulfilled all the qualifying criteria to be included in the research population.

Data Collection

Recruitment

Following the data collection requirements, I initiated the recruitment procedure by sending the invitations after receiving Walden IRB approval. Contact with each participant was done separately to maintain confidentiality. During the data collection process, participants were not aware of any other participants in their team. The selection of the teams and their participants were based on teams with the most experience working in self-managed team implementation.

I added the participants' information in a Microsoft Excel file. I assigned a code to each participant and used it in the next steps of data collection, such as recording video files for the interview, transcript files, and observations. This file contains participant code, participant's name, participant's email, consent received, team code they belonged to, date of arranged interview, completion of the interview, Transcript completion, and feedback on the transcript. The personal information (name and email) was only used in this file. Subsequent files used participant codes.

Recruitment started on June 18, 2020. After receiving the names and email addresses of potential participants from the lead in the participating company, I sent invitations to interviews along with Walden IRB-approved consent form to participants. As I received "I consent" emails from the participants, I emailed them to arrange the interview time/date. A total of 18 people received this invitation. Out of that, 14 agreed to

participate; two apologized, stating that they have not been in the company long enough to be able to participate, and two did not respond (22% attrition rate).

Location, frequency, and duration of data collection

Fourteen team members fulfilled the criteria of participation and consented to participate in the research. Invitations and consent feedbacks were done through email. All activities were in alignment with Walden IRB approval (06-10-20-045981). Interviews were arranged between June 30, 2020, and July 29, 2020, at times that worked best for participants. Transcript documents were sent back to each interviewee for feedback within 72 hours of conducting each interview.

The invitations were sent using my Walden University email account. I used the video-conferencing tool Zoom to arrange the interviews. All interviews occurred from my home office through video conferencing with participants residing at their home location. There was no order in the interview setup. Interviews were set at different times of the day according to the availability of participants within a week of their consent. I did not record the team of the participant until after the interview was completed to avoid any potential biases in asking different questions from team members.

Data Recording Procedure

At the beginning of each interview and after brief greetings, I read through the opening statements of the interview protocol (Appendix A) and asked the participant if they agreed to allow me to start recording. The Zoom video conferencing tool provides the feature for recording the video. During the interview, I recorded some observations based on how the participant provided the answers and some thoughts on follow up

questions. At the end of each question, I made sure that the appropriate answer had been provided, and if not, I asked a follow-up question based on the answers they had provided. This procedure led to approximately 60 minutes of interview time. After completing the interview, I transcribed the recorded video and sent back to the participants for review and feedback. Four participants provided minor modifications to the transcript provided. The rest accepted the transcripts either by sending a note or not providing feedback within a week after the transcript was provided, as per the approved protocol.

After completion of interviews and transcripts, I reviewed all transcripts and performed an initial hand coding. I went through the first interview and coded the answers based on the concepts behind the questions. The questions indicated the codes and categories to some extent, in alignment with interview structure and flow, which was aligned with the study's conceptual framework.

After coding the first interview, I created a matrix. Anticipating for codes to lead to categories, I created a tab for categories. I added description columns to codes and categories. As I did not anticipate the categories and codes to grow beyond 50 items, I decided to use longer and more meaningful code and category names to link them together.

I entered the first set of codes from the first interview and refined the codes as I noticed some duplicates. There were further refinements as I continued. For example, I assigned many groups of words in answers to TeamProcess code and initially separated DecisionProcess and TeamProcess codes. Still, TeamProcess code was later extended to

other procedures and processes like communication, learning, and work assignment. At the end of the initial coding and after the first interview, I had 32 codes.

A challenge I encountered was recording some information along with the initial coding. I decided to add this information in brackets after code. I was able to sort based on the original codes but then use the extra information during data analysis. I continued this procedure as I went through more interviews. I returned to previous transcripts with each new code and searched for similar feedback I had given a different code.

I used the Comment feature in Microsoft Word to mark the terms or phrases in the transcript files. After the final transcript initial coding, I used a macro to extract the comments into a Microsoft Excel file. This procedure transferred the comment, the phrase/words from transcript feedback, and the page in the transcript into a separate file. I stored these separate files but combined them all in a master Excel file. This initial raw data file had close to 1,200 entries or an average of 85 initial codes per transcript. I also transferred the team code for each participant to the raw file data.

In data analysis, each team presented a separate case for the multiple case study. The teams were coded as Cases A, B, and C for ease of reference. Each participant belongs to one of these teams. There were five participants from Case A, four participants from Case B, and five participants from Case C. It is not unusual for team members to switch between teams. As a result, during the interview process, it was emphasized to describe work experience based on the current team to avoid data analysis issues.

Variations in Data Collection

There was a minor difference in the data collection process and specified plan in Chapter 3. The interviews took place over 4 weeks instead of the 3 weeks planned. The extended duration was due to the availability of people and the vacation season. I sent reminders for the remaining potential participants to acquire the expected number of participants.

Data Analysis

Initial codes were categorized into five high-level categories. These high-level categories are depicted in Table 3 below. These categories were refined in the analysis process and led to themes. Themes were then used to understand the overall description of self-managed team processes across the three cases.

Table 3

High-level categories

Category Name	Category Description
Experience	Related to the experience of the self-managed team members
SMT	Related to the understanding of self-management within the team
Team Process	Related to the processes team use to perform various activities
Communications	Related to communications between self-managed team members
Decision	Related to decision-making processes

Theme 1: Experience

There were a few questions in the interview to measure the level of experience of team members working in a self-managed team. The codes related to the experience

category included company experience and experience in the self-managed team in this company. I also asked about any previous companies' experience and whether the team members were working for the current company when it went through a self-managed team setup. To measure the participants' experience, I asked how many work packages each team member had completed in the self-managed team setting.

Company experience showed how long the participants had been in the company. If team members worked more than 2 years in the company, they were considered experienced and otherwise novice. Experience working in a self-managed style varied across the cases due to teams getting onboarded and implemented at different times. For self-managed team experience, if participants worked more than a year in the new setup, they were considered experienced and otherwise novice. I considered the previous experience of the team members that had worked in a self-managed team setup before they joined the company and categorized accordingly. I also added a new code to the cases where they had similar experiences like the self-managed team but not precisely with all the required settings.

The next item related to experience was to note if team members worked in the company when the transition from traditional team management to self-managed teams happened. After reviewing this category and feedback, besides the simple yes/no answers, another category appeared. A few participants stated that they were not introduced to the new method through a formal announcement or a significant transformation event, leading to Explicit and Implicit codes. A summary of coding related to the experience theme is shown in Figure 1.

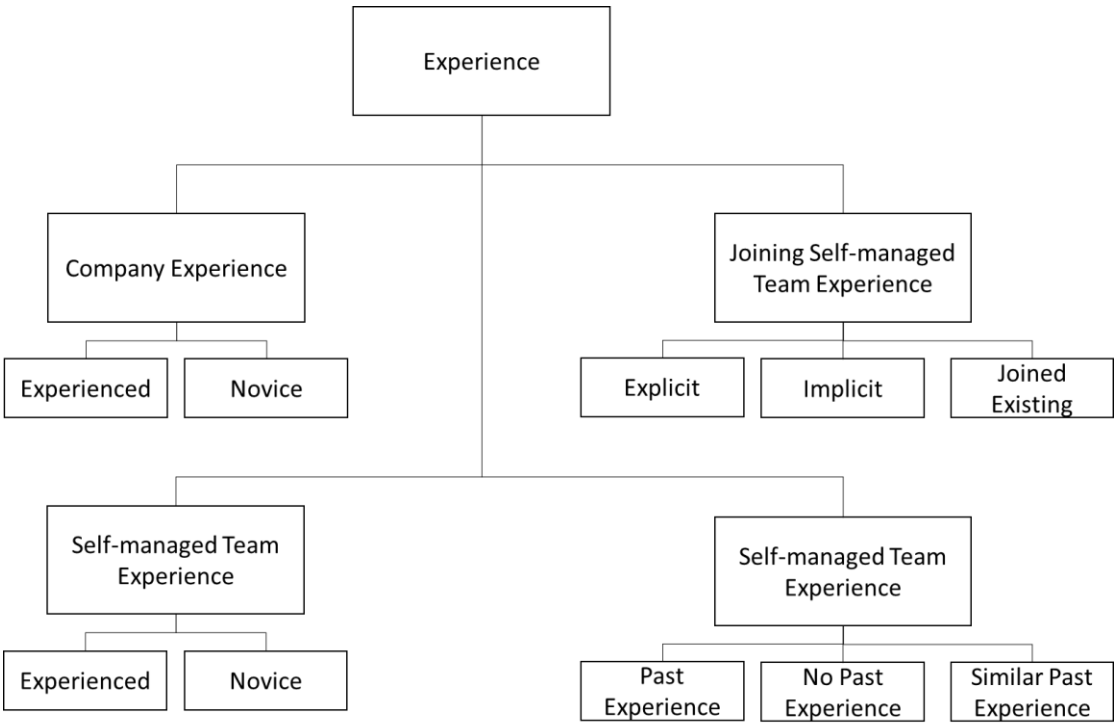

Figure 1. Experience theme, codes, and categories.

Theme 2: Self-managed Team

Feedback from participants on benefits from the self-managed team revealed a wide range of benefits. The feedback was grouped into several categories and subsequently contributed to four categories of Decision, Efficiency, Team, and personal betterment. The overall feedback was that self-managed teams have helped make better decisions, increased efficiency, improved teamwork, and contributed to improvements to team members' work/life.

Feedback, such as having an overall view of the problem, allows team members to gain a higher perspective of what the solution needs to be and decide better. Participants indicated that better decisions could be made by team members who are experts on topics. As all team members participate in the decision process, there is a

diversity of ideas in the decision process. These decisions are based on facts and what customers need. Autonomy was a repeating item in feedback received that is a construct for making decisions. The expert decision, having a high view perspective, diversity of ideas, and autonomy, led to better decision theme of the benefits of having self-managed teams.

On efficiency, categories derived directly from participants included concepts like getting done faster, more efficient, better outcome, and quality output. These categories all indicated efficiency as a subtheme of the feedback. Participants used phrases like “happier,” “excited,” and “enjoying,” describing their teamwork experience. Categories included satisfaction, motivation, personal growth, and higher retention, leading to a theme for the personal benefits category. Other categories like better teamwork, more trust among team members, and more engagement with the work and team provided the sub-theme for better teamwork.

Participants frequently coupled benefits with some boundaries that I categorized as constraints. Further analysis of feedback revealed a general project/work theme, consisting of the need to be on time, on budget, deliver the requested scope, and limitations to human resources available. Evaluation of success is a combination of the participant’s evaluation, the constraints, and the reality of measurements performed and monitored by the company. Figure 2 shows the categories of benefits, drawbacks, and constraints of the participating company's self-managed team.

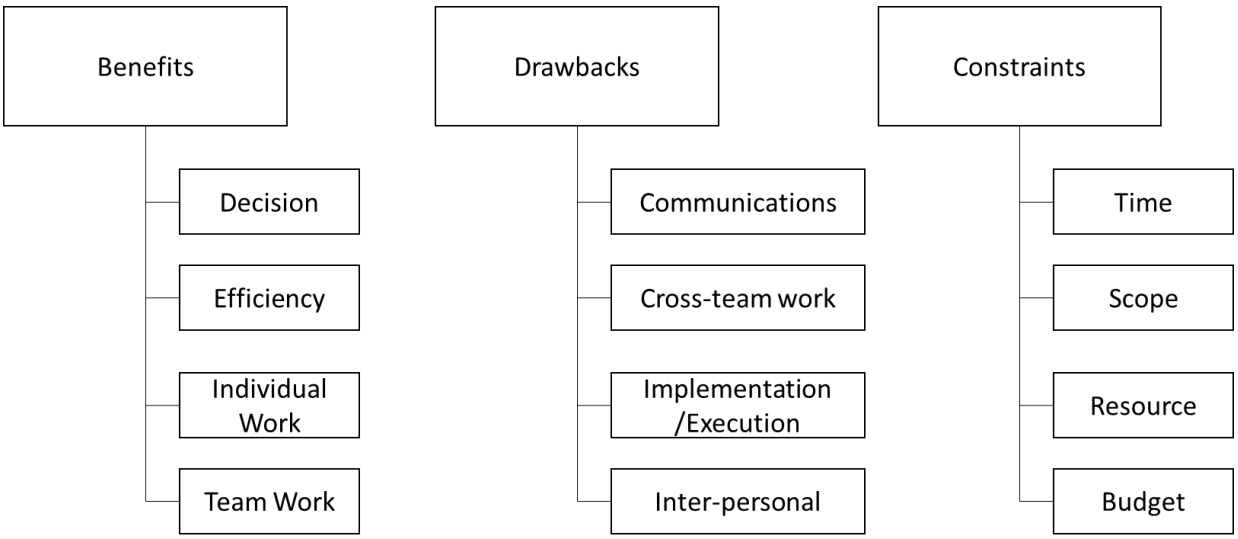

Figure 2. Benefits, drawbacks, and constraints categories

In mentioning the drawbacks, participants indicated how their teams were organized to overcome each challenging situation. This feedback was categorized into drawback response. Participants attributed the drawbacks not to the self-managed team's concept but to how communications happened, how the team was implemented, how interpersonal relationships got in the way, and how work was coordinated with other teams.

Responses related to how the work is structured and facilitated were categorized into two subthemes of task and collaborate. Categories under task are related to activities and facilities teams use to perform their tasks. The facilitate category is related to how team members collaborate in discussions and communication channels. Figure 3 shows these categories and themes.

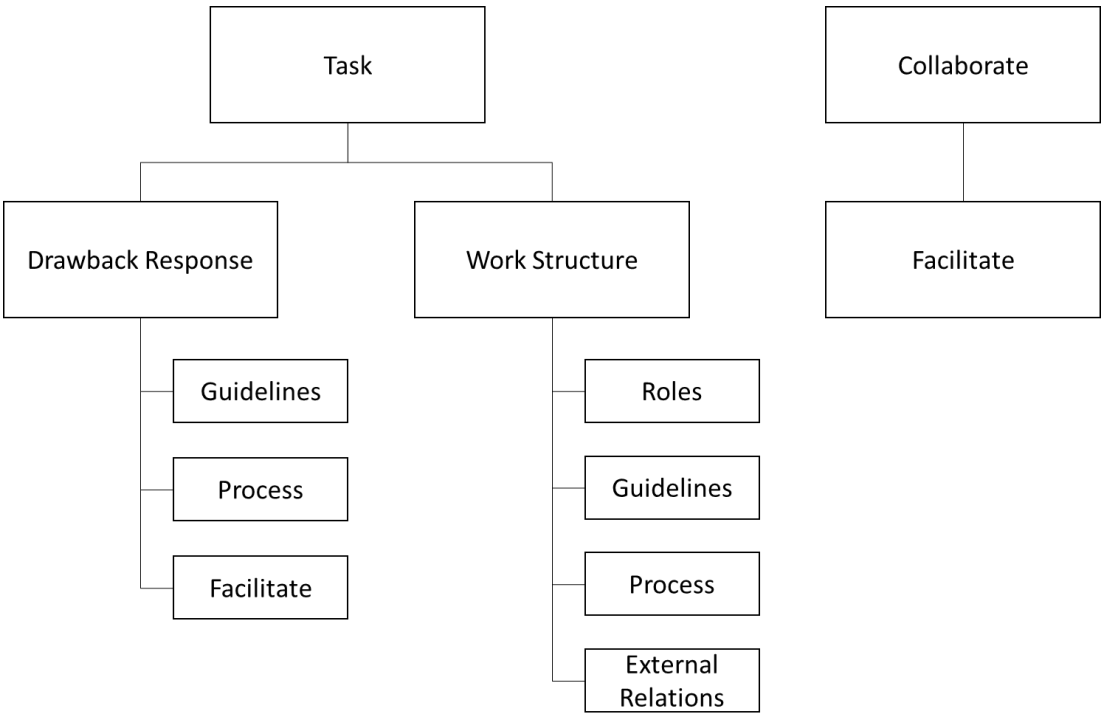

Figure 3. Structure for Task and Collaborate themes

Theme 3: Core Process

Most of the feedback provided by participants fit into three main processes: Core process (how team members accomplished their work), Communications process (how team members communicate between each other and with external teams), and Decision process (How team members in self-managed teams made decisions). The following sections provide a review of codes, categories, and themes derived for each. As expected, there are common themes between these processes that will be rolled up together in the results section.

The core process refers to all activities, settings, arrangements, and structures required for the team members to perform their job. The core process activities show the

work that team members do to accomplish various activities. Core process codes and categories led to themes summarized in the following table.

Table 4

Core Process Categories and sub-themes

Category	Sub-theme	Meaning
Assignment, Task revise	Task	Assignment is the work or the task that team members perform. Tasks get revised based on how team members are aware of changes happening and how they react to them to revise tasks.
Input	Goal	Various forms of input to the team, coded as a problem, work, metrics, and objectives, were categorized as input, which provided the team's theme of goal.
Output	Team Output	Various forms of output coded as package, code, design, software, metrics, and website were categorized as output and led to the team output theme.
Responsibility, Team Dynamics, Process Steps	Plan, Alignment, Team, Knowledge, Share, Collaborate, Experience, Lessons Learned	The team dynamic, responsibility, and process step codes led to themes on how team members accept responsibility and get aligned with each other, plan, share information, increased their Knowledge, worked as a Team, expanded their experience and added to their lessons learned, and collaborated to get the job done.

Theme 4: Communication Process

Communication is a critical activity in teamwork. Through the communication process, team members share various types of information essential for them to know, learn, collaborate, and work together towards the team’s goals. The table below summarizes the results of coding, categories, and themes resulting from revisions on codes.

Table 5

Communications Process Categories and sub-themes

Category	Sub-theme	Meaning
Contents	Contents	Concepts that need to be communicated.
Input, Get Feedback, Work	Internal Exchange	Team members seek input or get feedback for their internal teamwork.
Value	Value	The feedbacks participants provided indicating the value of communications.
Inform, Feedback, Request, Work	External Exchange	External communication is used to inform external stakeholders, feedback, request something, or work with other teams.
Website, Presentation, Demo, Email, Channel	External Medium	Team members use websites, presentations, application demos, emails, and communications channels to interact with external teams.
Boards, Channels, Meetings, Direct	Tools	Tools used to make communications happen.
Frequency	High/Medium/Low communications	Main team meetings that happen at different intervals. All feedback fits into daily, twice-weekly, or weekly.
Role	Breadth	How much team members' work involves communicating with other roles and teams.

On the value of communications, participants indicated that proper communications establish a cadence, allowing them to "know things are progressing," to have "best visibility" as "any misunderstanding gets corrected." Team members would go to other team members to understand what they need to do as input to their work and get feedback. Team members extensively use message boards to establish channels for the whole team, subgroups to discuss a particular topic, and communications with external

stakeholders. They can also use tools such as phone, face-to-face conversations, and meetings to communicate. In the second revision of coding roles, I included feedback from participants on how much they interact with others as their breadth of communications that can be used to show the extent of communication and work processes in general.

Theme 5: Decision Process

In making decisions, team members consider various inputs. Some of the items include scalability of products, ease of maintenance, "amount of time we need to work on something," and if "customers are suffering." Inputs to the decision process were categorized into growth, usability, cost, sizing, and complexity. These were rolled up to the decision factor theme. Team members use various tools in the decision process, including sharing sites, boards, and websites that facilitate voting. These tools are common across the three cases in the study. The decision factors are inputs to the decision process. The following table shows the categories and themes for the decision process.

Table 6

Decision Process Categories and themes

Themes	Categories	Meaning
Breakdown	Breakdown	Team members breakdown a problem into smaller pieces to understand it better and find the answers before making decisions.
Strengthen	De-risk, review, retrospective	Team members have methods for reviewing the decisions they have made to strengthen it. They also try to de-risk it by testing their decision results as early as possible. They also review their decisions in retrospective meetings to learn from their approach.
Discover Options	Discover, Investigate, Aid, Prototyping	Team members discover options through discussions, investigation, getting help from others, and consulting different sources, and in some cases doing a quick prototype to complete their options discovery.
Discuss Options	Discuss	Discussion is the main activity to review, revise, and consolidate options.
Opine	Participating	Team members are encouraged to participate and opine on options.
Subgroup	Subgroup	The team is broken into subgroups to research a particular issue.

In making decisions, team members have to respond to challenges that make following the process harder. The challenges were categorized based on participants' feedback. Two themes appeared: Personal and Technical. Personal challenges came from categories such as disagreement (team members disagreeing with others in a discussion), groupthink, attachment (team members getting attached to a solution without the right merits and not supported by data), and participating (members not participating in discussions for making decisions). On the technical theme, challenges happened when the decision was complicated and broad - categorized under Major Change -, when there

were missing information or lack of ideas on how to approach a problem – categorized under missing info/solutions -, or when there was a dependency on other teams or people outside of the team to get something done or provided.

Categorization of responses to these challenges led to three sub-themes: collect data, work as a team, and lessons learned. The team members started to collect various forms of data by gathering information, consulting with people, or directly get feedback from their customer community. To handle some of the personal challenges mentioned earlier, team members used team building techniques such as strengthening the idea of belonging to the team and team support, categorized under team advocacy, continuing to learn from situations categorized under learn-as-team work with external stakeholders categorized under align dependency. The following figure summarizes all categories, sub-themes, and themes in the decision process.

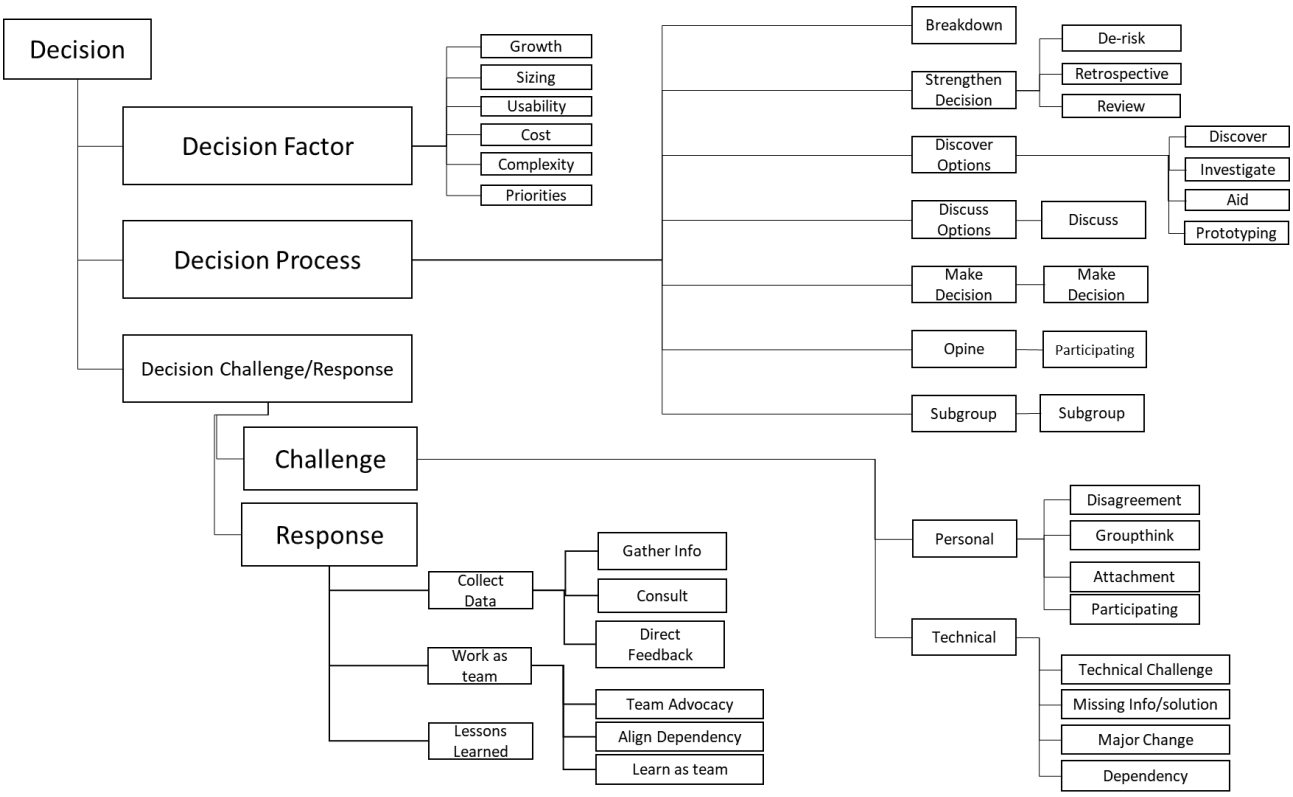

Figure 4. Structure for Decision categories, sub-themes, and themes

Performance of Teams in Cases from Participating Company

The participating company leaders have implemented self-managed teams. I summarized the information in this section based on the documents and feedback I received from company leaders. They monitor the progress of the teams via Key Performance Indicators (KPIs). Work is done by completing projects. Success is measured through accomplishing KPIs that include the following:

- Projects without a deadline:
    - Claim-to-Commit: Has the team been able to claim what they have committed at the time of planning. This indicator is not linear and depends on the number of team members working in the team.

- Projects with a deadline:
    - Date and Claim-to-Commit
- All projects:
    - Employee Satisfaction
    - Budget
    - Business goal: quarterly, Claim-to-Commit, and date of delivery is linked to business outcome. The business outcomes depend on sales and customer satisfaction

These KPIs can be met in full, partially, or the team can exceed the expectation. The summary of these KPIs for the team in each case is reflected in the table below.

Table 7

Summary of KPIs for each case in the study

Case	Date of delivery	Budget	Claim-to-Commit	Employee Satisfaction	Customer Satisfaction	Business Goal
Case A	Partial	Exceed	Partial	Exceed	Partial	Partial
Case B	Met	Met	Exceed	Met	Met	Met
Case C	Partial	Exceed	Partial	Exceed	Exceed	Met

There is a constraint on cases A and C. Team members of both A and C case studies handle ownership of multiple systems. Production issues and incidents are on team members to address. Even during a project with deadlines, they can be called to address these issues. This extra support has been attributed as the reason these two teams only partially meet some of their KPIs, with roots in the organizational structure and system ownership. There is a missing structure to own sustaining and supporting

production environment issues. In the absence of that, these development teams get impacted frequently and miss on their KPIs.

The team members in Case C have a limited and smaller group of customers. Team members have been able to establish a close relationship with their customer base. Due to a high level of interactions, they get a chance to explain, inform, and collaborate with their customers easier. In this way, they can keep customer satisfaction high. Because of this, they usually negotiate their business goals lower than capacity. Hence although they meet their dates and Claim-to-Commit only partially, business goals are met.

In summary, the team in Case B meets or exceeds KPIs and can be deemed successful. Teams in Cases A and C have challenges to deliver on time and deliver on promises, but in Case C, the team meets the business goals and gets happier customers by managing their expectations, which they deal with the same problems as the team in Case A.

Evidence of Trustworthiness

Credibility

I maintained credibility in various steps of the data collection and analysis, as indicated in Chapter 3, without deviation. I did not influence the recruiting process in any form. I followed the Walden University procedures in engaging with participants. I answered all their questions before, during, and after interviews. I followed all the interviews according to the interview protocol, which had open-ended questions. At the

end of each interview, I asked the participants to opine on any points and any previous questions, or if they had any questions of their own.

Member checking was performed by providing transcripts of interviews to the participants and asking them to review the feedback they had provided and if they wished to change anything or add any further information. Four participants provided small adjustments to the transcript provided, which was subsequently updated in the input files in the coding process. I also recorded my observations during the interviews, which I used to enhance the data analysis. I also received a summary of the performance of teams in each of the cases in the study on Key Performance Indexes (KPIs) used by the participating company to track the state of the team. I used this information in forming themes alongside the data collected from participants to form metrics of success.

I maintained a journal and reviewed it before each interview to avoid biases. In this reflexive process, I ensured that I did not influence the participants, especially when asked to clarify a question. I was careful to stay neutral in explaining the question and always started by repeating the questions instead of explaining it to avoid providing information that might lead to personal biases.

Transferability

I created a thick, inclusive description of codes, patterns, and themes to strengthen the transferability of the study. I looked at each element of data collected with multiple views. For example, if a transcript statement indicated a process that could be related to the communication process, making decisions, or general working routines, I created appropriate codes for all the potential aspects. I transferred these codes into an Excel file.

The associated process remained an attribute of each data entry that can be used for further analysis, comparing data with other research findings.

As noted in chapter 3, participants' past and present experience, education, and background provide a wide variety. Onboarding to the self-managed team in the combination of the team they work, a high number of projects, small to large, done by each team provided a wide variability within each case. These attributes contribute to and strengthen transferability.

Dependability

The element of dependability in this multiple case study was achieved by the open-ended question. Participants described how they worked in their current team and mentioned differences in previous experiences they had. Team members in IT companies work in markets that force them to accomplish their goals despite many changes. Project requirements and problems change over time. The way the team members of each case have adapted to these changes contributed to receiving a wide range of exceptions and changes in plans, thus increasing the research's dependability. I also collected field notes during the interviews and journal notes to enrich the conditions related to each participant's feedback and described my approach, reasons, and bias avoiding strategies in journals.

Confirmability

During data collection and data analysis, I avoided discussing my views to avoid influencing the answers. When I was asked to explain a question, at first, I tried repeating the questions exactly as they were, and if the participant still seemed hesitant, I'd explain

it by practiced paraphrased versions to avoid influencing the answer by my bias. Reflexive journaling helped to prepare for the next interviews. I was also careful not to show any signs of body language if participants mentioned anything in alignment with expected behaviors using biomimicking. Even if a participant mentioned a biomimicking concept, such as "we have a beehive mindset," I did not press on elaboration to avoid bias and strengthening confirmability.

Study Results

The research question was to understand common decision-making strategies for self-managed teams as experienced by team members using behaviors exhibited in intelligent swarms in an IT company in Toronto, Ontario. This section brings two aspects of the study together. These two aspects are biomimicking behaviors in teamwork and decision-making and description of teamwork and decision-making by team members. During the data collection and data analysis, I summarized themes contributing to decision-making, including experience, implementation of self-managed teams including benefits and drawbacks of the current implementation within each team, and key processes like teamwork, communications, and decision-making. I also summarized how these teams perform on their expected KPIs from the company leaders' perspective, which will be used in Chapter 5 to reach conclusions.

Team members that follow biomimicking behaviors have a good understanding of goals, respond to change collectively, understand the plan, value participation of all team members, have internal alignment, collaborate with external resources, share information frequently, value experience, and review their work to learn. Interview questions required

participants to describe how they perform their work in self-managed team implementation to see if they aligned with these biomimicking behaviors. On the decision-making process, the biomimicking behavior would be breaking down large items into smaller pieces for easier decision-making, discuss and validate options, strive to discover new options, divide into subgroups to find new options, opine on solutions presented and participate in discussions, and strengthen decision by communicating, reviewing and fixing its issues. In the following sections, using biomimicking behaviors, I present the results of the data analysis.

Experience

Considering experience is a key element in biomimicking behaviors. Experience of team members in each case, working in self-managed teams, working for the company, previous experience of working in self-managed teams, and onboarding the self-managed team in the current company has been reflected in tables 8, 9, 10, and 11. Previous experience before joining the current company is not much different, but the level of the experience of working in a self-managed team in Case B is more than Case A and Case C. This finding aligns with the importance of experience in biomimicking behaviors. The presence and participation of team members at the time of implementation of self-managed teams is higher in Case B and C, aligning with the better success of teams in these cases with KPIs.

Table 8

Experience of Team Members Working in Self-managed Teams per Case

	Experienced	Novice
Case A	80%	20%
Case B	100%	0%
Case C	60%	40%

Table 9

Experience of Team Members Working in Company per Case

	Experienced	Novice
Case A	40%	60%
Case B	100%	0%
Case C	80%	20%

Table 10

Previous Experience of Team Members Working in Self-managed Teams per Case

	Past Experience	No Past Experience	Similar Past Experience
Case A	20%	60%	20%
Case B	25%	50%	25%
Case C	40%	40%	20%

Table 11

Experience of Joining a Self-managed Team per Case

	Explicit	Implicit	Joined Existing Process
Case A	40%	20%	40%
Case B	50%	25%	25%
Case C	60%	20%	20%

Self-Managed Teams

The members of the three teams in case studies work as self-managed teams. In Case A, participants described the meaning of working in a self-managed team as relying less on management and raising matters to higher levels only when their support is required. They indicated that the core team members knew what needs to be done as they are the ones to implement it. They described the process of a self-managed team as "two-way communication" and felt that business teams that bring them problems to solve had an "open ear" to hear what the team has to offer.

In Case B, participants described that working in a self-managed team has led their clients to rely on them. They were the ones making the decisions, and in doing that, they had "a lot of leeways to choose what to do." This autonomy provided them the power to provide their viewpoint when needed.

In Case C, participants indicated that they decide on how to approach a problem. Members of self-managed teams know what needs to be done, and they can make key decisions on matters. One participant pointed out that "we have certain targets to meet so we cannot be fully self-managed, comparing what we have heard about freedom of teams in Google." In general, they indicated that their input is considered valuable, and with the autonomy they have in the team, they enjoy solving problems within the container of their scope. Evaluation of participants on the success of self-managed teams is shown in the following table.

Table 12

Description of success of Self-managed Team per Case

	Success	Neutral	Failure
Case A	80%	20%	0%
Case B	75%	25%	0%
Case C	100%	0%	0%

On the benefits sub-theme of working in self-managed teams and on better decisions, 80% of participants in Case A (4 out of 4) indicated better decision making due to autonomy, expert decisions, and diversity of ideas. The team members mentioned "managing ourselves," "not being micromanaged," and "autonomy to solve problems" as benefits of decision making. 75% of participants in Case B (3 out of 4) described better decision making in their self-managed team setting as a benefit, with "no micromanagement," "autonomy to achieve goals," and decisions "coming from people closest to the problem" as their reasons for improvements on decisions. Improvements on decisions were mentioned by 80% of participants in Case C (4 out of 5), with "transparency," "seeing the big picture," and "reason for why something needs to be done with a problem" as contributing feedback to value of higher visibility leading to better decisions.

On efficiency benefit, 80% of participants (4 out of 5) in Case A regarded less overhead, faster and better outcomes to their team's efficiency. This ratio was 75% of participants (3 out of 4) in Case B and 60% of participants (3 out of 5) in Case C. On personal benefits, 80% of participants (4 out of 5) in Case A, 100% of participants in Case B (5 out of 5), and 60% of participants (3 out of 5) in Case C described higher

motivation, satisfaction, higher retention and personal growth as the personal benefits of self-managed teams. Finally, on teamwork, 50% of participants in Case A, 25% of participants in Case B, and 100% of participants in Case C related to trust, better teamwork, and more engagement resulting from working in self-managed teams. More engagement was prominent in feedback from Case C (60% of feedback in the category) but, in Case A, all the feedback in the category and 60% of total participants in the team related to trust as the key teamwork dynamic.

Participants indicated various drawbacks. The results of sub-themes have been summarized in the following table.

Table 13

Number of Participants Providing Drawbacks Feedback per Case

	Communications	Cross-team	Implementation	Interpersonal
Case A	3	1	4	3
Case B	2	1	2	0
Case C	1	1	2	1

In an intelligent swarm, a key attribute is the participation of all members. Participants from Case A indicated they could make better decisions because of their autonomy in the self-managed team. They indicated that they are the experts on the matter, so they are better positioned to make the best possible decisions. They also referred to the diversity of ideas because of the participation of everyone. In cases B and C, autonomy and decision by experts were prominent feedbacks. Participants in Case C also liked the overview they had on why they were solving a particular problem, which

positioned them to make better decisions. They linked their decisions to customers and facts more than other teams.

On efficiency, team members from Case A indicated less overhead, faster, and better outcomes. In Case B, team members described achieving higher quality that had led to better products. In Case C, the team members put a lot of emphasis on having less overhead and faster processes. Working as a team in a self-managed style also has teamwork benefits. For team members in Case A, the emphasis was on trust, whereas in Cases B and C, they described benefiting from more engagement and better teamwork. From a personal perspective, a higher level of satisfaction and motivation were the benefits of working in a self-managed team in Case A. This feedback was the same in B and C cases, but they also mentioned personal growth and higher retention. Overall, all three teams participating in the study expressed value in the participation of all team members, although teams in cases B and C had more positive feedback on this topic.

Core Process

The following sections review the core team process theme based on how participants described the sub-themes of goal, alignment, collaboration, task (changes and revising tasks as the changes happen),

Goals: Goals and objectives of projects get communicated to the teams in the study as input to their work process. In Case A, participants pointed out that goals are presented to them by the product owner in the form of business requirements or problems. They have team meetings to understand their goals. As a result, before the work gets started, “everyone gets the collective goal.” In Case B, participants understood

that through a series of meetings, they get general problems or specific feature requirements that align with “strategic focus.” Team members in Case B pointed out different layers of goals as their input, from a business problem to design mockups and user stories, indicating a structured breakdown of problems as they progress through the process. In Case C, team members were extremely focused on customer problems and customer feedback while considering metrics such as the budget.

At a high level, all teams in the three cases of the study have some understanding of overall goals and objectives. Team members in Case A followed the process with no specific focus. In Case B, team members had a more structured approach in transforming goals to smaller objectives from business goals to user stories. In Case C, team members placed a high value on understanding goals from the customer's perspective and achieved customer satisfaction by setting and managing customer expectations.

Task: Intelligent swarms respond to change collectively. Team members of the teams in the study work together to address the required changes. Responding to customer problems is the key function that they transform into changes in products they maintain. As a result, I looked at tasks as a theme. Team members in Case A use a focused approach in resolving issues and making changes. They discuss changes in the context of responsibilities, delivery mechanisms, and unblocking the work for a teammate. In Case B, team members discuss a wider range of issues, including refining estimates, what needs to be done by whom, how to get things done better, the work process, and how they may even switch tasks between team members to make things go

smoother. In Case C, team members mentioned how they follow the process, work on one topic at a time, and prioritize “low hanging fruits.”

Plan: Planning for work in the participating company is part of the team process. Participating team members perform activities such as estimating, documenting details, and planning to agree between the team members and the company on how/when/what to deliver. Results from interviews showed that the team members in Case A and C engage in planning activities less than Case B. Team members in Case B also engage in preplanning activities that allow them to be better prepared and aligned for the plan execution.

Alignment and Collaboration: Alignment, as a theme in this study, is related to indications of team members relying on each other, accepting responsibilities together, and trusting each other at the team level. In Case A, team members indicated that trust, responsibility, and general agreement were their team alignment attributes. In Case B, team members had more emphasis on responsibility and a sense of ownership. In Case C, besides responsibility, members referred to team dynamics with phrases like “we are on the same page” and “team works very well together.”

Collaboration within the team happens in team processes like decision-making. Team members in Case B indicated less need for facilitation of discussions but discussions. Meetings and facilitation sessions were prominent topics brought up by team members from Case A and C. In a self-managed team that team members do many traditional activities associated with the manager, various activities may need team members' facilitation. Members in all of the teams frequently mentioned how they

collaborated with external teams and their customer base by demonstrating their work as they inform them, provide updates, get feedback, and establish alignment. In this aspect, team members in Case C indicated more frequent collaboration with external teams and customer base.

Knowledge, share, and learn: All the teams in the study follow the same review and learning process. After each delivery period, which could be as short as two weeks, team members meet with a wider audience that includes representatives of related teams like architects and product owners, to see how the past period went by, what was good and must be repeated, what had a negative impact and should be avoided and in general what can be learned from the past experience. This approach is the overall structure of all such traditional retrospective meetings, but in the participating company, the leadership team has created a culture of acceptance of failure and tolerance of opinions of others. As a result, everyone participates in the retrospectives, with the facilitator of the meeting going to everyone and asking for their input. It is well-understood that this is how the team learns.

Communications Process

Teams in each of the cases in this study use different approaches for communications. On the frequency of communications, members of Case A have formal meetings to communicate about their work daily. In Case B, team members meet daily but also have weekly meetings to sum up their communications. In Case C, meetings are twice weekly or weekly. Overall, the team in Case B has more frequent and structured

meetings for communications than teams in Case A and C, and the team in Case C has the lowest frequency of meetings.

Teams use various tools to communicate, including electronic/website boards, direct communications like meetings, face-to-face discussions, and instant messaging software. They all use the same toolsets that allow them to have direct, passive (people make information available on a channel or website), and visual (a physical or electronic board) communications consistently across all teams.

All the team members from the teams in the three cases of this study use communication as an integral part of their work. They all described the value of communications in different forms. Team members from Case A see communications as a way to inform all team members, provide an opportunity for everyone to participate, ask questions, get feedback, and make progress. For the team in Case B, communication value establishes a cadence for sharing information and alignment. For the team in Case C, communications provide the best visibility and a mechanism to correct any misunderstanding earlier in the process. These are not different views but reflect on internal team dynamics and importance to the team members.

Feedback from participants showed that the roles were clearly defined, with some emphasizing the importance of this clarity as “luckily” and “fortunately.” 80% (4 out of 5) of participants in Case A, 75% (3 out of 4) of participants in Case B, and 100% (5 out of 5) of participants in Case C mentioned multiple team roles. Using clear roles, responsibilities, and expectations will be clear too. In total, participants mentioned 15 unique roles. One indicator I considered was how many unique roles and how frequently

participants brought up roles in general. This information indicates communication breadth, leading to better communications between the team members of the same team and across different teams. The below table provides a summary of this indicator across each case. Using breadth, it is clear that team members in A and C do more communications and interactions with other roles internally and externally.

Table 14

The Breadth of Communications through Working with Roles and Unique Roles per Case

	Mention of Roles	Mention of Unique Roles
Case A	19	10
Case B	26	8
Case C	31	11

Decision Process

Intelligent swarms follow six distinct behaviors to make decisions. The following sections review the observed behavior in team members of each team in applying strategies for making decisions. After that, I will present the challenges that team members encountered when making decisions and strategies to resolve the challenges.

Breakdown: If a decision is about a large project or if there are unknowns about various aspects of the decision, members of intelligent swarms break it down into smaller parts so that they could manage each separate part before making a decision. All three teams in the study follow this pattern. Team members in Case A do this breakdown to identify the key parts to understand user stories associated with each part. They may decide to create separate work packages and even complete the work in multiple cycles. The breakdown happens less for team members in Case B. they break the customer

problems into subproblems and decide when to do each sub-problem. As indicated by one member, they “divide and conquer.” In Case C, team members decide to “go one step down” if they face a large problem to solve. They may consult with a senior member to help them to break it down into smaller components.

Subgroup: If team members are trying to decide about a problem with too many unknowns, they may divide the team into subgroups to develop different approaches. In the team of Case A, this could be due to insufficient information. Based on their role, they divide to do some investigation and regroup to present options. In Case B, team members solve this by defining tasks for subgroups or discussing it informally with other teams. They come back to the team level discussion to develop designs and use visualization approaches like creating mockups to present their findings. Team members in Case C rely on other team members or domain experts. Each person researches or simply asks external stakeholders like architects to help them with the direction. In short, Case A and C team members ask the domain experts for help, which constitute subgroups with extensions to the team members outside the core team, but in Case B, team members try to learn with internal subgroups and only reach out to external stakeholders on a consulting basis.

Discover options: In this pattern, members try to find all the viable options available to them. The discover-options theme is based on discovering viable options, investigation, prototyping, and aid categories of feedback. Team members use their knowledge, education, and experience to find viable options. They may do some investigation to come up with options. The whole team or team members may be tasked

to do a prototype to see if an idea is a viable option. They may benefit from structured aids such as a design sketching session. Members of the teams in all three cases in the study use these approaches to discover options. In Case A, team members mostly brainstorm and help to visualize the discussion in sketching sessions. In a sketching session, team members draw their ideas on paper or the board (physical or electronic) and generate solutions. In Case B, team members also do sketches. They are encouraged to come up with as many ideas as possible, "no matter how crazy." Team members participate in short discovery rounds: they are given a few minutes to ponder on the topic, come up with as many solutions as possible, and then present it in one minute. This process helps discover numerous solutions and avoids the attachment of people to a single idea because they have had a short time to invest in it. Team members in Case C use sketches and short discovery rounds and research their competitors' designs to see what they can learn and may even reach out to the customer base to get more ideas in.

Discuss options: Team members discuss options to understand and improve the options. Each team benefits from different techniques. Team members in Case A use whiteboards, open discussion, brainstorming, fact-based reasoning, and a score to prioritize based on the combination of the number of customers affected, confidence in the solution, impact, and effort. Discussion between team members in Case B is also in free form and based on evaluating the complexity of options, minimum viable product, and value-adding capability of the options. In Case C, team members also benefit from brainstorming and whiteboarding, but they rely on role-based recommendations rather than team-level discussions and voting.

Opine: After discovering options, self-managed team members participate in activities that lead to choosing the desired option or making a decision. The process is simple as the teams' size is small, so a quick vote usually works. However, members of teams in the study use various tools and techniques to ensure everyone's input and participation. Team members of the team in Case A try to get to a consensus, but they use voting if there are any doubts. They use online tools and post polls so everyone can go and vote. Voting is done anonymously, so the act of voting does not influence people. If the decision is about selecting a few items among a larger number of options, they each get 3-5 votes, which they can "spend" on one or more options. In Case B, voting is not that common as the team discusses various options to get to a consensus. Team members may apply the same multiple-vote method when they can have more than one outcome. Team members in Case C are encouraged to participate in the discussions by the facilitators. They vote on options using online tools. There is an emphasis on the "people weighing in" and "democratic" approach. The team members leave decisions to the expertise of each role and only vote on items that can affect everyone.

Strengthen decision: Implementing a self-managed team in the participating company encourages the team members to participate in the decision-making process without the fear of failure. The process has a corrective mechanism in the form of retrospective discussions happen every two weeks. Team members review and discuss how they did over the last working period and learn together as a team.

Team members in Case A mentioned various review points, including design review and code review. They de-risk the design decisions by trying them early in the

process to revise their decision if they need to. In Case B, team members have the same review points. To de-risk, they do rapid-prototyping and hold a demo session to show their work and decisions they have made and get early feedback. In Case C, team members may decide to run Proof of Concept (PoC) on large decisions to see which option works better. Developing PoC may not be possible due to time and cost factors.

Overcome Decision-Making Challenges: Self-managed team implementation in the participating company provides methods for decision-making. Compared to traditional team management methods, team members should have methods to overcome similar challenges without the constant support of a manager. During data collection, team members of all teams brought up various issues and the solutions they had in place if the challenge arose. In the categorization of issues, I concluded two different themes for these challenges: personal and technical. Personal challenges arise from team members' disagreement, groupthink, attachment to personal views, and refuse to participate. On the technical side, challenges include dependency on other teams, missing information or solution, and dealing with major changes. Regardless of the type of challenge, team members try to overcome them by collecting data (gathering information, consulting, getting direct feedback) and working as a team (team advocacy, align on dependencies, learn as a team). In the following sections, I review how team members of each team deal with these challenges.

Team members in Case A described a variety of challenges that they encounter and have to resolve. On the personal side, if there is a disagreement between team members, they ask for supporting data. By reflecting on facts instead of emotions, they

reach a logical conclusion using reasoning. They may decide to consult with more experienced stakeholders outside of the team, like architects. If the disagreement is on estimations, they work as a team and discuss further to bring their estimates closer and go with a higher number to avoid under-estimations. To avoid personal attachment to a solution, they hold ideation sessions, providing a short time for members to develop solutions. Having spent a very small amount of time, team members do not get attached to the ideas and evaluate all suggestions equally.

On technical challenges, team members in Case A collaborate and backtrack to find which decision led to the situation if something is not working. Suppose there is missing information, or they do not have a solution to a problem. In that case, they collect the data and investigate the solution (this pattern was reviewed earlier in the Subgroup and Discover Options sections). If the change is major, they approach the decision with more investigations and discussion and may consult with other stakeholders like a product owner. In some cases, the team members may vote for direct customer feedback. They can “hire” customer groups to participate in their discussion and even be part of their pilot runs to come up with the best decision.

Team members in Case B did not describe any personal challenges. On the technical side, if there are dependencies, they try to coordinate with external teams, and if there are delays, they postpone decisions/work on the topics until clarity has been provided. If something goes wrong, they review it in retrospective to avoid it in the future. If there are specific scenarios or “edge cases,” they document them and work to get the missing information.

In Case C, team members described dealing with disruptive team members by asking to back up their idea using data. They mentioned allowing team members to opine on their fields of expertise, but they asked all team members to comply with majority votes, even if it meant a failure point, and they would have to reverse the decision. They advocate working as a team and even fail as a team, as it is not seen as a failure, but a learning opportunity, or as a team member described, “live and learn.” The team has experienced cases that they could not decide between two opposing ideas. In those situations, they decide based on a-b testing, a method with a small population of end-users who see two different product versions. The team members track each option's success to extend the better solution to all customers, allowing customers’ actual preference to be the final decision-making factor.

Summary

This chapter presented a detailed analysis of the descriptive multiple case study to answer the research question: What are the common decision-making strategies for self-managed teams as experienced by team members using behaviors exhibited in intelligent swarms in an IT company in Toronto, Ontario? The responses team members were coded and categorized into six main categories: experience, role, SMT (Self-Managed Team), team process, communications, and decision. Codes and categories were then structured to lead to themes. These themes were mapped to behaviors identified in Chapter 2, as observed in intelligent swarms. I provided a summary of these behaviors and the evidence of applying similar patterns in self-managed teams in each case, with some variances as they each have adopted approaches that work best with their environment. I

also received and summarized the key performance indicators that the leaders of the participating company track to measure each team's success. Findings showed that all behaviors of biomimicking could be observed in how teams in the study work. Chapter 5 consists of an in-depth interpretation of the study's findings, limitations, recommendations, and implications for research and positive social change.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this qualitative descriptive multiple case study was to describe common decision-making strategies for self-managed teams as experienced by team members using behaviors exhibited in intelligent swarms in an IT company in Toronto, Ontario. A descriptive multiple case study was appropriate for this study as the purpose was to gain a unique view on how team members described their work processes, including making decisions. The case study was suitable as the boundary between team members' working context, and the implementation of a self-managed team was not clear. Having multiple cases provided multiple data points (see Zainal, 2007), increasing credibility.

The study was conducted to address the literature gap related to how a decision-making process suitable for self-managed teams can be implemented. Liff and Gustavson (2016) provided high-level guidelines for self-managed team implementation but did not address the decision-making approach and implementation challenges. Biomimicking of intelligent swarms provides a wide range of behaviors for team members to follow, supported by similarities between the autonomy of self-managed teams and behaviors exhibited by social beings in intelligent swarms, applicable in various teamwork activities such as decision making.

Findings from the analysis of collected data show that biomimicking and learning from intelligent swarms can provide appropriate guidelines for implementing successful self-managed teams. All nine behaviors for general work processes and six behaviors of decision making considered from biomimicking exist in implementing self-managed

teams in the three cases in the study. Existing variances will be reviewed and interpreted in this chapter for more accurate guidelines, followed by recommendations and implications.

Interpretation of Findings

For successful implementation of self-managed teams, organizations should go through a transformation (Gupta et al., 2017) that can enable team members to use the autonomy they have in a self-managed approach and work effectively (Renkema et al., 2018). In this study, I considered a recommendation from Kennedy et al. (2015) on applying biomimicking as a source of innovation. I investigated the potential benefits of understanding group behavior between humans and social beings, as recommended by Tindale and Kameda (2017), in the context of self-managed teams.

Based on a conceptual framework consisting of teamwork, decision making, and sociobiology constructs, I considered elements of self-management using self-determination theory (Deci, 1971), social learning theory (Bandura, 1979), and social choice theory (Arrow, 2012). Implementation of self-managed teams must guide leadership, communications, and decision making to avoid challenges that have lowered the performance of self-managed teams.

The fundamental difference between self-managed and traditional teams is the autonomy of making decisions (Muthusamy, Wheeler, & Simmons, 2005). To efficiently enable a self-managed team, team members need to address challenges like polarization and groupthink (Kelman et al., 2017), low synergy, and team cohesion weaknesses. This study extended the application of intelligent swarms into self-managed teams using the

same simple rules that social beings exhibit by showing how team members in an IT company described decision-making strategies.

The learnings from social beings provided nine behaviors for teamwork and communications processes. For the decision process, six behaviors were mapped to decision patterns. In the following sections, I review the findings and provide interpretations based on participants' feedback and the company's KPIs.

Experience

The theme of experience is related to team dynamics and the teamwork element of the conceptual framework. On experience, team members in Case B are all experienced working in self-managed teams. They are also all experienced with the company and its processes. Case C and Case A follow Case B, in that order. Other indicators measured in the study, like previous experience and experience joining the self-managed team between the three cases, are too close to use for comparison purposes. Team members in Case B meet all their KPIs. Case C follows, with meeting customer expectations and business goals but only partially fulfilling their delivery and claim-to-commit KPIs.

Self-Managed Team

The self-managed team theme is directly based on the self-management element of the conceptual framework. Comparison between Tables 7 and 12 shows that success in the implementation of the team with better results is not related to how participants described their self-managed team's success status. Comparing the benefits feedback across the three cases shows similar decision-making improvements, but team members

in Cases A and B worked more effectively than Case C. Teams also differed in how team members considered personal value. All team members in Case B saw personal benefits in the self-managed team, which can be linked to their success in achieving the organizational KPIs more consistently.

Full participation by all team members is a theme related to the self-management construct in the conceptual framework. On valuing participation, swarm intelligence is possible when all members participate in serving higher goals like survival. Absolute participation is a more complex problem for team members due to differences in personalities and other options available to them. However, the implementation of a self-managed team creates a level of autonomy and freehand in decision making, to the degree that they are motivated, engaged, and want to stay and contribute. Observations showed that Teams B and C show a stronger participation value (20% more than the team in Case A). As a result, they have a higher sense of belonging and a slightly higher sense of success in the context of self-managed teams. This description helped the team in Case B meet its KPIs and helped the team in Case C to connect to its customer base to set the right expectations and achieve customer satisfaction. On the personal side, all team members across the three cases indicated they are satisfied by their work and motivated to do better as a result. Members from Cases B and C also mentioned they were growing at a personal level, and they have observed much higher employee retention as a result. As Table 13 shows, team members in Case A have more issues and drawbacks than Cases B and C, confirming more successful outcomes for those teams. Team members in Cases B and C showed higher participation, which is a key biomimicking behavior,

aligning and confirming the confluence of the emerged research pattern and biomimicking behavior.

Core Process

The core process theme includes elements required for performing the jobs of the team, related to teamwork construct of the conceptual framework of the study, building on stages of teamwork (Tuckman, 1965). On awareness of goals and responding to changes, teams in all three cases follow the biomimicking behavior of understanding the goals with a slight difference in using them within their process. There is no KPI for understanding the goals. Team members in Case A focus on their current goal. When a change happens, they must redirect their efforts to handle the change. This finding aligns with performance results for Case A, as they do not fully meet the business goals and customer satisfaction. In Case B, team members have a structured approach to goals as they break it down from overall goals to user stories that they work on, and at the same time, they monitor a wide range of changes. Team members in Case B meet the business goals and customer satisfaction KPIs. In Case C, team members have the same challenge of changing and redirecting their resources, but they focus on customer needs and constantly consider delivering value to customers. As a result, they exceed customer satisfaction and meet business goals.

Lack of incorporating larger goals for the team in Case A has led team members to be more focused on solving more immediate problems and disconnecting from larger-scale changes. Members of intelligent swarms respond to change collectively while moving towards the overall goal. Missing delivery dates and Claim-to-Commit

milestones are symptoms of this lack of focus for the team in Case A. Team members in Case B follow the process closely and show more flexibility in switching tasks between themselves to keep the goals of the projects intact. As a result, they meet their delivery dates regularly and normally exceed their Claim-to-Commit KPI (meaning they deliver more than they commit). Team members in Case C work on one item at a time and give priority to easier items. As such, they may not give enough priority to more important items, which is why they miss their delivery and commitment KPIs.

The planning theme is related to the self-management aspect of self-management in the conceptual framework. On planning, the results indicated that team members in Case B do more planning and engage in preplanning activities. Biomimicking behavior from intelligent swarms indicates the importance of understanding the plan by everyone, especially when there is an emergency change. Although all teams engage in planning activities, a higher level of engagement indicated by participants in Case B and the preplanning activity has helped the team do better in achieving KPIs of delivery dates and Claim-to-Commit.

Alignment and collaboration themes are directly related to the teamwork theory aspect of the conceptual framework of the study as they contribute to team dynamics and how the team will be able to go through various stages of Tuckman's (1965) model. Alignment and collaboration are two of the traditional teams' constructs, but a self-managed team should have been implemented so that these functions can work without the supervision of a manager. Most of the team's input consists of goals and objectives. These get communicated to the teams in the study in the form of customer problems. The

implementation of a self-managed team in the participating company makes it clear that the responsibility of solving the problem is with the team members. Once the problem is understood within the context of the team, team members commit to delivering the solution to the problem. That commitment and responsibility are understood across the three teams in the study. Besides the responsibility, participants in Case A indicated a strong sense of trust between team members. They work with each other to get to an agreement. In other cases, there are team dynamics such as a sense of ownership and cohesiveness, so team members work together to come up with solutions, plans, and delivery.

Collaboration happens through various communication forms, but in essence, team members gather in a physical or virtual room to discuss the problem. A major difference between traditional teams and self-managed teams in the participating company is facilitation. At each stage of problem solving, a lead role facilitates discussions. This feedback to other team members and playing the facilitator's role aligns with similar behaviors in intelligent swarms, with members closer to the external change initiating the call to action.

The team learning theme is a key construct in the conceptual framework of the study related to social learning theory (Bandura, 1979). On learning, all the teams in the study follow the review and retrospective processes and meet after each work cycle to review how they did and evaluate their performance. This approach aligns with the biomimicking behaviors of learning lessons from experience. In reviewing KPI as all the teams follow this process consistently, no case-specific conclusion can be provided.

Communications Process

Communication is the underlying theme in the conceptual framework of the study, connecting teamwork theory, self-management, decision, social choice, self-determination, and sociobiology constructs together, enabling accomplishing tasks to go beyond each team member and towards a team. On communications, constant sharing of status and information is a repeating biomimicking behavior. Members of intelligent swarm constantly monitor their surroundings and react to changes. Others follow a change initiated, and as a result, swarm behavior appears. In the view of participants in the study, communications happen for reasons such as sharing, participating, establishing a cadence, visibility, and de-risking. Case B had the highest frequency of official communication points between the three cases in the study, and Case C has the least. On the variety of roles, important for communications to happen in between, Cases A and C have wider communication points. Combining these two findings, team members in Case B benefit from more focused and more frequent communication as it has helped them meet business goals and customer satisfaction. In Cases A and C, the wider range of roles means they must work with more people, showing that their type of work requires having more communication points leading to missing some business goals. Team members in Case C exceed customer expectations that can be interpreted as a customer-oriented mindset as they give priority to visible issues to customers but miss other goals.

In the conclusion of teamwork and communication processes, a closer implementation and following of biomimicking behaviors have led to more team success. Team members in Case B match with more of these behaviors, and they succeeded in

meeting all their KPIs and exceeding in few. Team members in Case C focus on customers and have been establishing processes that help them achieve business goals and customer satisfaction KPIs but only partially meet delivery and Commit-to-Claim. They can increase their planning efforts, change management and responsiveness, and internal communications to overcome their challenges. This approach applies to team members in Case A, but they also have to increase their external communications and manage expectations.

Decision Process

Autonomy to make teamwork-related decisions is a fundamental attribute of self-managed teams. Intelligent swarms make decisions fast and effectively by applying the processes. The decision process consists of breaking down a large decision into smaller ones, subgroup to understand all aspects, discover as many options as possible, discuss the options, participate in discussions and opine, make decisions, and strengthen it by reviews and learning. Not all these components may be done on the same decision depending on how much team members know about it, if there is missing information, or if the team has made similar decisions before. The following sections provide an interpretation of findings on these components. All aspects of the decision process tie back to decision theory and social choice theory in the conceptual framework as team members share their thoughts and experiences in the form of options to make decisions, as well as teamwork theory as the team members review available paths to solve a challenge while going through various stages of team building towards normalization stage (Tuckman, 1965).

Team members in Cases A and C indicated they encounter decisions that they had to break down into smaller pieces, more than members in Case B. This difference is because team members in Case B do this by transforming goals into smaller steps, and when it is time to decide, they already have user stories to look at instead of a big unknown problem. If they have a bigger problem to solve, they bring it up in their daily meeting, and the whole team participates in the discussion. In Case A, breakdowns happen internally, whereas in Case C, they consult with external stakeholders. Regarding dividing teams into subgroups, all teams in the three cases subgroup to discover missing information, but the difference is that in Cases A and C, this is done by role, meaning that the team members with specific roles like developer or designer take a problem away and try to solve it however in Case B team members discuss it at the team level.

On discovery of options, all the teams in the study perform sketching sessions to help them visualize what the results should resemble. They brainstorm and engage in short round sessions that help them to come up with many ideas in a short time. In Case C, team members perform an extra step and check the competitors' designs to see how they can learn from them.

On discussing and opining on options, all teams have free-form conversations as they review aspects of what they need to decide. These discussions are facilitated by one of the team members, depending on where on the process the team is. For example, in the beginning, the product owner facilitates the discussion while communicating the customer's problem. After that, a system analyst or business analyst will facilitate so team

members can develop an approach. Next, a designer will facilitate so they can come up with design ideas.

In many cases, team members reach a consensus, and there is no need for voting. Team members in Cases A and B use a simple voting method to choose one option. If they can choose more than one item (for example, they can start working on three user stories and they want to vote for the priority among the next ten items), then they use a multi-vote method. Using an online tool or a whiteboard, team members get two or three votes, and they spend their votes on what they think matters most. Team members in Case C give priority to the roles in voting. For example, it is up to a designer to choose a design unless they want to consult with the team.

In Case A, team members encounter personal challenges like disagreements and attachment to one's ideas. They have methods to encounter for each type of these issues. On the technical side, if there is missing information, they collect it from the input source like business unit lead or customers. Team members in Case B have been able to resolve their personal challenges in the decision-making process, so they remain focused on technical aspects. They ask each other to support the claims by data, and if there is missing information, they strive to find out. In Case C, team members also look for data to support discussions. When making hard decisions, they try to de-risk it by running it to fail or succeed as early as possible, so they have time to correct it. These slight differences in Cases A, B, and C have led to different KPI results. In Case A, many of the KPIs are missed because they do not prepare for emergencies and have to overcome personal challenges in the decision-making process. In Case B, they do not miss on

external changes and are ready for them. They do preplanning, which helps them be more realistic about their commitments, and they have already figured out to work as a team. This approach can be related to their experience as the most mature self-managed team across the three cases in the study. In Case C, team members face similar problems as Case A, but their approach in finding drawbacks of their decisions sooner and closer collaboration with customers gives them an advantage on business and customer satisfaction KPIs, even though they miss delivery dates and claim-to-commit indicators.

Limitations of the Study

Case studies are generally limited to the specific case in the study. Although a multiple case study provides more context and enables comparison and deriving richer conclusions, it is still bound to the specific context of the scope of the cases in the study. Another limitation of the study is the lack of comparison between the implementation of the self-managed teams in the participating company and other companies that have done the same. The research is also limited in supporting previous research on the interdisciplinary view of self-managed teams and biomimicking behaviors.

Access to participants was limited to those working in target self-managed teams and only team members who chose to respond. Concerns of privacy, confidentiality, and openness to discuss all topics were reviewed with participants through the interview process, but the study is limited in the ability to validate the depth and totality of feedback provided.

Recommendations

This study was the first of its kind in the interdisciplinary field of self-management and sociobiology. This originality presented itself as a limitation of the research in lack of similar studies but provided many opportunities in future research. The findings showed an alignment between successful self-managed team practices with intelligent swarm behaviors, which open a whole new field and future research possibilities.

Like any academic research, this study started with a passion for seeking the possibility of learning from nature. History is full of lessons humans have learned from observing nature and even the behavior of social beings. The question at the beginning of the journey of the research was to see how we can learn from the behavior of social beings in management. Like all other academic research, I had to go through a long process to narrow down the scope of the research to be able to achieve the quality of academic research and findings within an acceptable timeframe. The areas that were excluded from the research can guide future researches.

Implementation of self-managed teams varies across different companies as it depends on many different factors, including decisions on decentralization, level of self-management, applying required changes (Lee & Edmondson, 2017). For that reason, scholars either have provided high-level guidelines (Liff & Gustavson, 2016) or elaborated particular areas of interest in self-managed team implementation like leadership style (Stewart et al., 2011) or success (Wageman, 2001). This study set a new source of simplifying the variances that the organization's leaders will have to decide

when implementing a self-managed team by following behaviors exhibited in intelligent swarms.

This study described the decision-making process in self-managed teams in one particular company. Findings showed that the closer the behaviors of biomimicking were followed, the better results were achieved. Although the study provided insights into other processes of teams, such as communications, collaboration, and alignment, future research should consider studies with a focus on other processes, including elements of team dynamics like trust or cohesiveness of team members.

This research was done on teams in an IT company in Toronto, Ontario. Simple replication of the research in other IT hub cities in North America or other continents can extend the understanding of effective self-managed teams. A comparison of those results with the findings of this study can provide new insights into the effects of geographical locations or cultural backgrounds. Similar researches can be done in industries other than IT to see if biomimicking behaviors can improve self-managed teams.

The approach and research design for this study was a qualitative descriptive multiple case study. Other research designs may be more suitable depending on the types of self-managed teams. For example, a service company with many small self-managed repair teams can be studied using a quantitative approach with variables such as service duration and hours of experience.

This study was done in a company with self-managed teams already implemented. The purpose was not to compare the states of KPIs before and after the implementation of self-managed teams. Possible future research can be to study the state of KPIs as team

members transit through the implementation. Such a study will help to guide for transforming a traditionally-managed team into a self-managed one.

This research described some of the drawbacks that occur as a result of working in self-managed teams, including disagreements, groupthink, and fear of making wrong decisions. Although the findings of this study guide to avoid these challenges and resolve them when they happen, a recommendation for future research is to focus on these drawbacks and research how biomimicking can benefit towards overcoming these particular issues.

The background and experience of organizational leaders can be a major factor in the implementation of self-managed teams. One finding in the research was that groupthink was a challenge in discussion but no more than traditionally managed teams. Team members pointed out that dealing with specific problems such as groupthink requires responsible leaders for the implementation of self-managed teams to be familiar with this issue and provide avoidance process for it; however, many of these leaders may not have the background to know its effects as they normally rise in ranks from technical backgrounds. As a result, future research on leaders' backgrounds and experiences who implement self-managed teams may provide insights into this matter.

New biomimicking behaviors may help extend the recommendations of the implementation of self-managed teams. Seeley (2010) started his research on the honeybee decision-making process years before new video technology enabled him to find the underlying approach bees follow for making decisions and how they move the

colony towards the new nest. Field researchers will continue to discover new behaviors that may be useful for self-managed teams or other aspects of management.

Implications

Methodological and Theoretical Implications

The gap established and elaborated in the literature review of this study was the lack of guidance in implementing self-managed teams in processes like decision making. The findings of this study contribute to fill the gap in the implementation of decision-making strategies in self-managed teams and help to establish an interdisciplinary field that sets biomimicking as a learning source for management. This study contributes to research to understand group behavior between humans and social beings (Tindale & Kameda, 2017). Biomimicking behaviors were constantly present and helped to improve the successful outcomes of self-managed teams in the study. The study's findings showed that following biomimicking behaviors by members of self-managed teams improves their work experience and outcome.

The descriptive multiple case study provided the right approach to establish biomimicking behaviors as a source for successful team behaviors. Principles of social-determination theory (Deci & Ryan, 2012), social learning theory (Bandura, 1979), and social choice theory (Arrow, 2012) structured the framework to look for behavioral learnings in intelligent swarms. These behaviors were based on Wilson’s sociobiology theory. The results contribute to the social determination theory on how team members are motivated to participate and benefit from the autonomy they have in the implementation of self-managed teams. It strengthens social choice theory in reaching

consensus in self-managed teams and de-risking the decisions by being open to revising if needed when the early results of feedbacks become available.

Recommendations for Practice

The results of this study may be used by organizational leaders in the implementation of self-managed teams in general, and specifically, the decision-making approach. The findings showed that members of self-managed teams handled challenges of working in such teams easier if their established team practices that were closer to biomimicking behaviors. These behavioral learnings can be simplified in response to team members' challenges, from technical/work perspectives to team/personal challenges. Biomimicking behaviors presented in the study for the successful self-managed team also support Ginnett's team leadership model in achieving a high-performance team (Hughes, Ginnett, & Curphy, 2009) and can provide an approach to implement such teams. Ginnett's model provides components for establishing a high-performance team, including outcomes acceptable to stakeholders, the satisfaction of team members, and improvement in the future capabilities of the team. The biomimicking behaviors presented in this study support all of these components, plus they can be used to establish guidelines to implement self-managed teams and resolve their challenges.

Social Change Implications

The findings in this study showed that the implementation of a self-managed team closer to biomimicking behaviors could lead to personal motivation, satisfaction, and loyalty. 80% (4 of 5) of team members from Case A, 100% (4 of 4) of team members from Case B, and 60% (3 of 5) of team members from Case C directly mentioned

satisfaction, personal growth, higher retention (loyalty), and motivation as a direct benefit of working in a self-managed team. Team members in Case B led others in following biomimicking behaviors, achieving consistency in member KPIs, and delivering on projects consistently.

More success and consistency in teams that follow biomimicking behaviors will enable team members to manage challenges, collaborate within the team and outside of the team with other business units and customers, speculate the upcoming changes, and organize more effectively. Implementation of self-managed teams using biomimicking behaviors is simple, such as the behavior of social beings that inspired them. These achievements may stimulate leaders of other teams within the organization or other organizations to implement biomimicking self-managed teams. Achieving more goals and objectives will enable organizational leaders to align resources better, amplify organizational and personal achievements, and may lead to positive social change.

At a personal level, satisfaction and growth will lead to a healthier state of mind for team members, inspire more work innovations, and contribute to better work/life balance. This state will have positive effects on the larger scale of families and society. At the organizational level, having a simpler and more successful approach in implementing a self-managed team will inspire more leaders to adopt such teams in their organizations. It will help overcome the challenges that have slowed the implementation of self-managed teams (Lee & Paunova, 2017). Organizational leaders will anticipate the challenges, facilitate the implementation of self-managed teams, and validate the

decisions earlier and faster. These improvements will lead to saving limited organizational resources.

From an educational view, this study may inspire business schools to consider a new perspective in management practices inspired by nature and provide organizations with new methods to manage complicated situations using simple rules of biomimicking behaviors. This awareness will allow institutionalizing the approach as an advanced yet simple method of setting teams and organizations for success. With increased public knowledge about the benefits of biomimicking self-managed teams, organizational awareness on the societal level will increase and contribute to solidifying issue preventions (Simard & Lapalme, 2019). Higher appreciation of organizational and personal outcomes may lead to larger-scale positive social change.

Conclusions

Organizations have suffered from the low performance of teams, which have led to low levels of satisfaction, motivation, growth, and lower rates of employee retention. Organizational leaders apply various approaches to stimulate members of their teams and increase performance and outcomes. Self-managed teams have been implemented as one way of more participation, inspiration, and performance, but the adoption rate has been slowed down due to common challenges that team members encounter. The success of self-managed teams depends on how it is implemented within the organization, but traditional methods applied along with previous research results provide inadequate guidelines that are high level and do not address the challenges directly.

This study's approach is based on social choice, social learning, self-determination, and sociobiology theories to provide a new approach to supporting self-managed team members in encountering challenges of working in such teams. This new biomimicking self-managed team implementation will allow organizational leaders to have simple guidelines in the form of proven biomimicking behaviors to apply in their teams' implementations and benefit from higher personal, team, and organizational outcomes. Employee satisfaction and retention will enable the organizational leaders to plan their limited resources better and advance their contribution to positive social change. My study's findings may help reshape how teams and companies are organized as the units of performing activities towards high performing teams, learning, and satisfaction at personal, organizational, and societal levels. I hope that this unique and unprecedented approach in the implementation of biomimicking self-managed teams inspires further studies of potential opportunities in this interdisciplinary field.

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Appendix A: Interview Protocol

Date:

Start time:

Stop time:

Total Time:

Participant code:

[*Interview session starts*]

My name is Mohammad Nozari, and I am a candidate for PhD degree in Management at Walden University. Thanks for participating in my study. This interview will take approximately one hour. The purpose of this qualitative descriptive multiple case study is to describe common decision-making strategies for self-managed teams as experienced by team members using behaviors exhibited in intelligent swarms in an IT company in Toronto, Ontario. The purpose of the interview is to help me understand how decisions are made in self-managed teams in your company from your perspective. As indicated in my invitation, you will remain anonymous in this interview process. The questions are open-ended. I may take notes during the interview. You may choose not to answer to the questions you feel uncomfortable with, and you can terminate the interview at any time. Do you have any questions before we get started?

Interview Procedures

I am requesting that you permit me to conduct an audio-recorded interview for about 60 minutes. Transcriptions of interviews will be analyzed as part of my course. I

will provide a copy of your interview transcript within 72 hours from the interview. You can review and revise and send it back to me. If you approve of the transcript, please send me an acknowledgment within 48 hours of receiving the transcript. If I do not receive feedback within a week, I will assume you have reviewed and are in agreement with the transcript. If the transcript requires revision, I will apply the requested edits and return for final review. After that, and in the case of further required edits, I will ask for a quick phone conversation to finalize the document.

Voluntary Nature of the Interview

This interview is voluntary. If you decide to take part now, you can still change your mind later. I will not use the information I have collected in this interview and purge the recording and my notes.

Risks and Benefits of Being Interviewed

Being in this interview does not pose any risks beyond those of typical daily life. There is no benefit to you.

Privacy

Interview recordings and full transcripts will be shared with each interviewee. Transcripts with identifiers redacted may be shared with my university faculty along with my analysis. The interview recording and transcript will be destroyed as soon as I have completed my research.

Interview questions

The interview questions are designed in an open-ended style. They are ordered from easy to more complex questions. I am going to start recording. For the record, please confirm you have read and signed the consent form.

[*Demographic questions regarding participation in self-managed team*]

a. Were you working in the company when the concept of self-managed team was implemented in your organization?
b. How long have you been working in a self-managed team setting?
c. Had you been working in a self-managed team before this company?
d. How many projects, products or work cycles have you worked in a self-managed team setting?
e. Would you describe working in self-managed team setting as successful, failure or neutral?
f. Based on your actual experiences, describe the benefits of self-managed teams?
g. Based on your actual experiences, describe the drawbacks of self-managed teams?

[*Questions related to observed patterns in intelligent swarms and positive biomimicking*]

1. How do you describe your understanding of the process of communication of goals and objectives of the project/work cycle at the starting point of work?
2. Based on your actual experiences, how do you describe how decisions are made on what needs to be done by each team member and whether/how team members are encouraged to participate in decision-making process?

3. How do you describe your understanding on how information is shared among team members and how frequently this happens?

[*Questions related to decision making in self-managed teams, according to positive patterns observed in intelligent swarms for biomimicking*]

4. How do you describe the process and experience of making decisions in self-managed team?
5. Based on your actual experiences, how do you describe how options for a decision are discussed *(If participant needs elaboration, provide examples like, are there iterations, led by person who thought of an option, how missing information are collected*)?
6. How do you describe how decisions are communicated outside of team?
7. Based on your actual experiences, describe how the decisions are reviewed to make improvements for future decisions.

Closing Interview

Thank you for your time and feedback. I will send the transcript within the next 72 hours. Do you have any questions or concerns?

[*closing dialogue and end of interview*]