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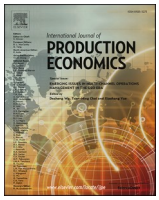

Conflicting paradigms in manufacturing and marketing decisions: The effects of situational awareness on team performance

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ABSTRACT

The ongoing shift from product-centric to consumer-centric operations highlights the market pressures that force organizations to stand out by satisfying customers. One way to achieve a smooth transition to the consumer-centric operation is to minimize the internal conflicts and improve the processes of demand-generating (marketing) and product-generating (manufacturing) functions. The collaboration of teams can be complex due to the idiosyncratic team members' situational awareness – the accuracy and agreement of the interpretations of the business environment. Drawing on the situational awareness theory, this research proposes that a team's ability to accurately understand and agree on the manufacturing and marketing business environment is associated with improved team performance. The theoretical model is tested using 667 experienced MBA students, representing 145 teams. The results suggest that team performance is significantly associated with the degree to which teams accurately understood, but not necessarily agreed upon, the manufacturing and marketing environments in which they operated.

1. Introduction

The ongoing shift from product-centric to consumer-centric operations highlights the competitions and market pressures that force organizations to stand out by satisfying customers (Lütjen et al., 2017). Organizations in manufacturing industry are increasingly seeking new ways to improve customer satisfaction. One way to achieve a smooth transition to the consumer-centric operation is to reduce potential conflicting objectives of demand-generating (marketing) and product-generating (manufacturing) teams (Galbraith, 2005; Yu et al., 2013) in order to improve internal coordination of processes. Although prior Operations and Supply Chain Management (OSCM) research shows evidence of marketing and manufacturing cross-functional coordination in improving performance outcomes, it is limited to contexts such as new product development (Hong and Hartley, 2011), quality management (O'Neill et al., 2016) and cycle time reduction (Hult et al., 2004). In addition, current conceptualizations of managerial decision-making center on behavioral and cultural aspects of information flow and inter-functional coordination but neglected the cognitive, sense-making aspects of decision-making (Bonney et al., 2016).

Inter-functional coordination can be more complicated than perceived due to contradictory operational objectives in organizational design and idiosyncratic team members' cognitive awareness of the environment. For example, a manufacturing and marketing team conflict can be the difference between an organization's capacity planning versus long-range sales forecasting – a problem that frequently occurs with new product development (Ehie, 2010). A new production line capacity is usually based on an agreed-upon forecast, but during the time it takes to design and build the line, the forecast may change.

Existing product short-range sales forecasting and production scheduling is another conflict area (Tang, 2010). Marketing teams tend to complain about the slow response of manufacturing teams, while

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manufacturing teams disparage marketing team's unreliable product forecasts (Shapiro, 2014; Johnston, 2016). As an example, Samsung rushed its Note 7 mobile phone to the market without subjecting the batteries to independent testing. The batteries overheated causing the phones to catch fire. The phones were taken off the U.S. market. (Minter, 2016). In this article, we argue, according to the situational awareness theory, that decision makers have their own unique interpretations of the uncertain environment. The idiosyncratic understanding and disagreement of external environmental uncertainty, such as competition and demand, amplifies the struggles between marketing and manufacturing teams (Wellens, 1993). This is of increasing concern given the shift from product-centricity to consumer-centricity which requires companies to respond quickly and accurately to customer demands.

Situational awareness theory suggests team members' perception and comprehension of a business environment enhances their capability to make accurate decisions regarding likely future events in that environment (Endsley, 1997; Matthews et al., 2004.) Research on team situational awareness has focused on two distinct elements – team-accuracy and team-agreement (e.g., Marks et al., 2000). Team-accuracy is defined as the team members' aggregated perception and comprehension of the meaning of information related to the business environment, such as manufacturing and/or marketing business environments. While team-agreement is the degree to which team members have the same understanding of the business environment (e.g., Endsley, 1995b). However, the simultaneous consideration of these two distinct concepts has not been sufficiently examined which represents a clear gap in the literature. In addition, research shows that team members' understanding of the business environment varies depend on the stage of the environment – whether it is current or future stage (Calantone et al., 2002; Hult et al., 2004; Fugate et al., 2009). Specifically, current environment reflects the teams' access and affordability of information within their existing business environment. This differs from the future environment which depends on the forecasting generated by the teams. Much of the prior literature, however, has been conceptual in nature and has not considered agreement about the expected future state of the environment. Drawing on situational awareness theory, this research considers both current and future states of the environment. The accuracy of, and the agreement about both the current and expected future business environment situation is necessary to avoid confusion, conflicts, inefficiencies, and to achieve aligned manufacturing and marketing decisions. Thus, our *first intended contribution* addresses this gap by examining the direct impact and the interplay of team members' situational awareness (i.e. team-accuracy of, and team-agreement about the current and future marketing and manufacturing business environment) on team performance.

The *second intended contribution* of this research is to advance our understanding of the impact of the cognitive and sense-making dynamics of team members on team performance (Matthews et al., 2004; Bonney et al., 2016). Studies of organizational conflicts have been focused on firm-level investigations. We argue that an in-depth understanding of the cognitive aspects of team members and their impact on performance will help managers identify additional factors of inter-functional conflicts and could alleviate the conflicting paradigms. Although theory development around operational ambidexterity has received substantial attention in the organizational behavior and applied psychology literature (e.g., Mathieu et al., 2008), less attention has been paid in the manufacturing and marketing functions (e.g., Pagell and LePine, 2002; Nath & Mahajan, 2008). This research gap is salient because using teams to address decision-makings that involve inter-functional impact is important given the ongoing shift from product to customer-centric operations. Marketing is external customer-focused, while manufacturing is internally process-focused (Swink and Song, 2007; Ho and Tang, 2009; Oliva and Watson, 2009). Their distinct objectives imply unique tendencies in interpreting the business environment around them. Given these differences, neither function will logically have a comprehensive view of the business and the competitive environment. Consequently, neither function will have all of, nor agree on, the available information that might support good decision making. Thus, our second intended contribution is to facilitate a deeper understanding of inter-functional conflicts through the investigation of the situational awareness of teams.

Much of the research that considers the concepts of situational awareness accuracy or agreement about the environment has relied upon managers' self-reported measures (Menon & Varadarajan, 1992; Devaraj et al., 2007). While there are benefits to self-report measures (e.g. Slater and Narver, 1994), the validity of self-reported, subjective measures has limitations. In particular, self-reported, subjective measures may contain random error as respondents may remember figures incorrectly or may guess (resulting in Type II error). Similarly, there is the possibility of systematic bias creating relationships between practices and performance that do not really exist (Type I error) (Wall et al., 2004). To overcome this limitation, we use **a cognitive-based business simulation of 667 experienced MBA students representing 145 teams. This methodology allows for the matching of** team members' perceptions of the environment with actual environmental conditions, which represents our *third intended contribution* – capturing and providing empirical evidence of the importance of both the accuracy and agreement of team members' understanding of the marketing and manufacturing environments on team performance. This research approach can directly capture the impact of team members' situational awareness – a factor of inter-functional conflict that can be very difficult to measure, therefore, easily neglected, in an actual business environment. Although conflicts cannot be completely reconciled, our findings show that the improvement of team-accuracy bolsters higher performance.

In the following section, we first review the theoretical foundation and relevant literature. We then present the conceptual model followed by the formal hypothesis development of each relationship. Subsequently, the method section details our data collection. Finally, the results section includes a review of the findings from the hypothesis testing, robustness testing, and is followed by a discussion of the implications for theory/practice, and limitations/suggestions for future research.

2. Theoretical foundations

2.1. Manufacturing and marketing environments

The ability to accurately decipher and agree on knowledge about a business's operational environment determines what actions firms are capable of taking, as well as how they coordinate and integrate their efforts (Tortoriello and Krackhardt, 2010; Zhang and Zhao, 2010). Accordingly, gaining an accurate understanding of *both* the manufacturing and the marketing external environments is a key enabler for improved strategy and reduced conflicts especially under the current consumer-centric shift (e.g. Ferdows, 2006; Browning and Ramasesh, 2007; Peng et al., 2008). However, the differing perspectives of these two functions (Duplaga and Pinto, 2002; Swink and Song, 2007), makes it difficult to acquire and agree on information about the manufacturing and marketing environment for use *by both* functions.

Drucker (1973) referred to the disconnect between demand creation (marketing) and production (manufacturing) as the "Great Divide," whereby firms are often trapped in a pattern of reacting to the whims of the business environment because they have failed to develop a proactive, strategically designed and appropriately integrated operations capacity. It is increasingly challenging for those involved in making manufacturing (internally/process-focused) decisions and those making marketing (externally/customer-focused) decisions to agree (Swink and Song, 2007; Ho and Tang, 2009; Oliva and Watson, 2009). Therefore, both an *accurate* and *agreed* upon the understanding of the external manufacturing and marketing environment is important to achieve

coordinated decisions and to improve business performance in lieu of local optimization of individual functions (Tang, 2010; Boyer and Hult, 2005; Young et al., 2011).

Numerous approaches have been suggested for the marketing and manufacturing functions to acquire accurate and agreed upon information. Some of these approaches include job rotation, co-location, workspace redesign, informal socialization, common incentives, matrix organizations, liaison personnel and production planning systems (Balasubramanian et al., 2002; Calantone et al., 2002; Pagell and LePine, 2002; Blumenfeld and Inman, 2009). The use of teams to promote the sharing of information is also frequently cited in the management and psychology literature (Mesmer-Magnus and DeChurch, 2009). Likewise, the focus on teams in both the manufacturing and marketing literature is increasing (Pagell and LePine, 2002; Nath & Mahajan, 2008; Peng et al., 2008). For instance, quality management initiatives (e.g., kaizen and quality circles teams) have led to the increased use of cross-functional teams to address added work interdependencies (Chen and Paulraj, 2004; Blumenfeld and Inman, 2009). Similarly, cross-functional teams are employed to work on customer order-fulfillment and manage the process from order entry, production (e.g. kitting and assembly), to final delivery (Davis-Sramek et al., 2010). Further, global-sourcing cross-functional teams manage sourcing strategies that impact manufacturing decisions such as the selection of global supplier locations (Moses and Åhlström, 2008). These teams frequently include members from functions outside of manufacturing and marketing (Trent and Monczka, 1998), yet they are responsible for developing and implementing both manufacturing- and marketing-related strategies and decisions (Pagell and LePine, 2002).

2.2. Internal functions of teams

As a shift from product-centric to consumer-centric becomes inevitable, managers realize that they must become proficient in the appropriate use and design of marketing and manufacturing teams. Prior research suggests that team management should be adopted for supply chain management, new product development, and quality initiatives as a method of ensuring that individuals from the various functions share their diverse information and experiences with each other (Pagell and LePine, 2002; Goh and Eldridge, 2019). However, the operations and marketing literature has yet to fully consider the underlying factors that allow teams to truly leverage the diverse information that may reside within teams involved in both manufacturing and marketing decisions. We address this gap and inform our first intended contribution by examining the means by which team members capture and agree on manufacturing and marketing information.

Most relevant research in operations and marketing adopted a macro orientation, examining the relationship between the use of teams and organizational outcomes (e.g., Petersen et al., 2003; Paulraj and Chen, 2007; Thomé et al., 2012), rather than assessing the internal functioning of the team itself (Pagell and LePine, 2002; Hoegl et al., 2003). For example, research on teams in the operations management and marketing literature has largely focused on the relationship between various organizational antecedents and team performance (e.g., Sethi et al., 2001; Chen et al., 2010). In contrast to this "macro" view of teams, much of the existing research on teams in the organizational behavior and applied psychology literature has adopted a "micro" orientation, intended to improve our understanding of the within-team elements of team performance. If one looks to the broader organizational team literature, there are two primary categories of mediators that may help to explain these relationships. Specifically, team processes represent actions and behaviors exhibited by team members in an attempt to reach the team objective and includes constructs such as communication, conflict, coordination, and motivation (e.g. Cohen and Bailey, 1997). The second type of mediator considered within the team literature is emergent states, which are cognitive, motivational, or affective states of teams and includes constructs such as trust, commitment, and team confidence (e.g. Marks et al., 2001).

Team processes have been examined within the operations and marketing literature. For example, research considered factors such as decision-making and communication (Moses and Åhlström, 2008), information generation and dissemination (Fedor et al., 2003), and information application (Sarin and McDermott, 2003). However, consideration of emergent state constructs within the operations and marketing literature is less developed. To address this theoretical gap and inform our second intended contribution, our work includes an emergent state (i.e. situational awareness) that has not been considered within the manufacturing and marketing contexts, but is especially salient to a team's accuracy of, and agreement about the external environment.

2.3. Situational awareness theory

Situational awareness theory considers the cognitive process involved in perceiving and comprehending the meaning of a given environment, leading to the ability to make timely and good decisions regarding likely future events in that environment" (Matthews et al., 2004, p. 149). As this definition suggests, it involves the team's *perception* of the environmental elements that result from the process of situation assessment (Endsley, 1995b), the comprehension of the meaning of the pattern of environmental elements, and the ability to *project* the state of environmental elements into the near future.

Research in the area of situational awareness has traditionally conceptualized such awareness in terms of either accuracy or agreement. In fact, some research has examined accuracy or the extent to which team members have an accurate understanding given the team members' responsibilities and the team's task (e.g. Endsley, 1989). As such, this is typically conceptualized as the sum of the team members' individual accurate understanding of the environment (Salmon et al., 2008). In comparison, as detailed by Salmon et al. (2008), agreement refers to the level of overlap in understanding between team members. Therefore, while both team-accuracy and agreement have been examined in the organizational behavior and applied psychology literature, it has too often focused on *either* team-accuracy or team-agreement and has not considered these two conceptualizations simultaneously – a gap in the literature that we seek to address in support of our first and second intended contributions.

Further, a questionable assumption embedded in prior work is that access to larger amounts of manufacturing and marketing information results in a more *accurate* understanding of the competitive environment (Choo et al., 2007; Zhou and Benton, 2007). However, in order for agreement about the manufacturing and marketing environment to be particularly useful to decision makers, it *must first be accurate!* Though accuracy of information (the degree to which the information corresponds to objective truth) has been investigated (e.g. Menon & Varadarajan, 1992; Low and Mohr, 2001), few studies have been able to empirically assess the objective accuracy of management's understanding of the competitive environment, and thus, its impact on desired outcomes. Such research has relied on managers' self-reporting of accuracy (Menon & Varadarajan, 1992; Low and Mohr, 2001; Devaraj et al., 2007), and has not matched perceptions of the environment with actual environmental conditions. We inform our first and third intended research contributions to address this gap by matching team members' perceptions of the environment with actual environmental conditions, thereby objectively measuring the accuracy of, and agreement about both the marketing and the manufacturing environments.

In summary, to address each of the aforementioned gaps in the operations, marketing, organizational behavior, and applied psychology literature, we focus on the teams' level of *both accuracy* of, and *agreement* about *both* the *current* and *future* manufacturing environment and marketing environment and what effect this has on team performance.

In the following section, we develop a theoretical model (see Fig. 1) that hypothesizes relationships between manufacturing and marketing

team-accuracy and agreement on team performance.

3. Hypotheses development

3.1. Manufacturing and marketing team-accuracy on team performance

Manufacturing and marketing team-accuracy is defined as the team's perception and comprehension of the meaning of information related to the manufacturing and marketing environments, leading to the ability to make both timely and correct predictions regarding likely future events in that environment (Endsley, 1995a, 1997; Matthews et al., 2004). Teams involved in both manufacturing and marketing decisions must take a dynamic view of the manufacturing and marketing environment and monitor and adapt to the environmental situation (Paiva et al., 2008). All too often though, the formulation of team strategies and decision-making reflects an inaccurate understanding of the environment (Germain et al., 2001; Kirca et al., 2005). Decisions resulting from an inaccurate understanding of the environment can waste team resources and lessens the chance of goal achievement (Badri and Davis, 2000). In the absence of an accurate understanding of the environment, team members will not be able to ascertain whether the decisions made by other team members were the best ones, and thus, learn from and improve upon decisions over time (Mumford and Gustafson, 1988). Conversely, greater the accuracy of each team member's perception and comprehension of the *current* manufacturing and marketing environment, as well as the ability to accurately project the *future* environment, enhances team decision making resulting in achievement of objectives. Thus, in support of our first intended contribution, hypothesis 1 states:

H1$_{a,b}$: Team performance is positively associated with (a) manufacturing team-accuracy and (b) marketing team-accuracy.

3.2. The interaction of manufacturing and marketing team-accuracy on performance

While the previous hypothesis suggests that either manufacturing accuracy or marketing accuracy is independently expected to improve team performance, we also are interested in assessing the interaction of these two forms of team-accuracy. We expect additional benefits when the team has *both* an accurate understanding of the manufacturing environment and an accurate understanding of the marketing environment. For instance, teams involved in supply chain decisions are often faced with managing the firm's imbalance between demand and the ability to produce products (Fahey et al., 1999). In fact, demand and production are very rarely in balance. When demand exceeds production, shortages result, customers become frustrated and sales revenue is diminished. When production exceeds demand, assets are under-utilized, inventories grow, and costs escalate (Swink and Song, 2007). For teams involved in manufacturing and marketing decisions, this imbalance is heightened if the team has an inaccurate understanding of the manufacturing or marketing environment (Day, 1994).

Teams with both high manufacturing and marketing team-accuracy are able to *jointly* consider relevant production and demand information. The more accurate a team's manufacturing *and* marketing understanding, the more likely that their production and marketing decisions are to be aligned. Teams are poised to improve operational efficiency, while maintaining the necessary level of marketing effectiveness since they provide the opportunity to simultaneously analyze accurate manufacturing and marketing information. If team decisions are based on an accurate understanding of the manufacturing *and* marketing environment, ensuing decisions will be associated with improved performance and customer satisfaction. Thus, teams exhibiting higher levels of both manufacturing and marketing team-accuracy should reduce redundancies, conflicts, and confusion in making manufacturing and marketing decisions and, consequently, improve the performance of the team. Thus, in support of our first intended contribution:

H2. There is a positive interaction effect of manufacturing and marketing team-accuracy on team performance, i.e. manufacturing (marketing) team-accuracy positively enhances the effect of marketing (manufacturing) team-accuracy on performance.

3.3. Manufacturing and marketing team-agreement on team performance

Situational awareness theory suggests that, in addition to the team-accuracy, it is important for team members, involved in manufacturing and marketing decisions, to reach an agreement on business environment. Specifically, team-agreement is the degree to

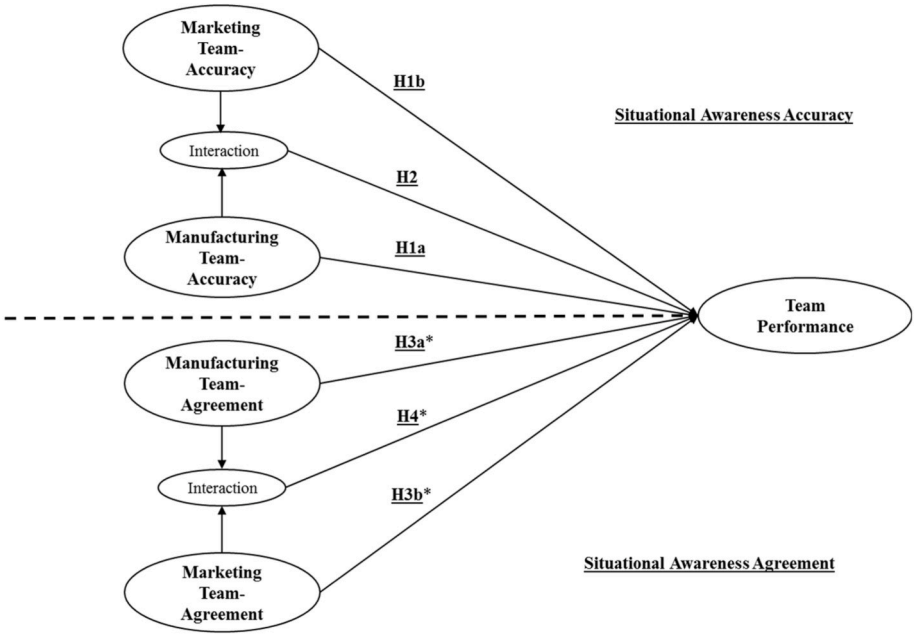


Fig. 1. Research model.

which team members have the same understanding of environmental factors (Endsley and Jones, 2001). As mentioned previously, research with the situational awareness literature has considered the impact of both agreement and accuracy although these two conceptualizations have rarely been considered within a single study – a gap in which this study intends to address. We argue that the impact of team-agreement is based on the level of team-accuracy because without a correct understanding of the business environment, team-agreement will probably generate more harm than benefit.

As an example of agreement among team members, consider the following scenario of a commodity-management team with six members. Imagine three of the team members accurately notice that several competing manufacturers' new supplier quality initiatives have raised the product quality standards in the industry (one manufacturing environmental factor). Consequently, they direct sourcing strategies of the team toward identifying new suppliers and developing existing suppliers to increase supplier quality levels. Unaware of the quality challenges, however, the other three members accurately discover their firm's production costs are substantially higher than the market average (another manufacturing environmental factor) and accordingly direct efforts of the team to identify new suppliers and develop existing suppliers to lower raw material costs to offset manufacturing costs. While all six members accurately understand parts of the manufacturing environment, the team lacks an overall agreement about environmental factors (quality vs. cost). This results in confusion, conflict, and inefficiency with regard to the team's involvement in making manufacturing decisions. This hypothetical example stresses the additional importance of manufacturing team-agreement beyond the main effects of accuracy.

Previous research contends that overlapping information provides a basis for commonly directed effort among organizational members (Eisenberg and Witten, 1987). If team members have disparate views of the manufacturing or marketing environment, they may act in disharmony. The greater the degree of agreement amongst the team members, the better able the team members will be in aligning their decisions and creating an effective response to the environment (Maltz and Kohli, 1996). Teams making manufacturing decisions that are reconciled with manufacturing environmental factors (e.g. industry production cost initiatives) will be more likely to develop a collective manufacturing response to the market (Calantone et al., 2002). Further, the higher level of agreement of the marketing environment (e.g. competitor product developments), the more likely they will be able to implement a unified marketing strategy. Thus, in support of our second intended contribution of examining *both* the team members' *accuracy* of and *agreement* about the current and future marketing and manufacturing environment, hypothesis 3 states:

H3$_{a,b}$: After controlling for marketing and manufacturing team-accuracy, higher levels of (a) manufacturing and (b) marketing team-agreement is associated with improved team performance.

3.4. The interaction of manufacturing and marketing team-agreement on performance

Manufacturing agreement or marketing agreement taken independently are expected to improve team performance, we predict an additional positive impact on team performance when a team has agreement on the manufacturing environment and on the marketing environment. The physical separation and differences in goals, responsibilities, reward systems, personality, language, and culture are some of the key barriers to harmony across decision-makers in these areas (Calantone et al., 2002). Such dissimilar "thought worlds" result in each team member having distinct and sometimes opposing views of the current business situation. Teams with responsibility for manufacturing and marketing decisions tend to focus only on a slice of the environment from the view of the majority of the team's respective area of expertise (Pagell and LePine, 2002). For instance, teams involved in manufacturing decisions may have an accurate understanding of production capacity issues and process innovation in the environment, but have very little understanding of competitor promotions and changes in customers' desired values (Swink and Song, 2007). Regardless of how accurately teams understand their situation, a lack of agreement on both functional domains results in misaligned manufacturing and marketing strategies and uncoordinated decisions (Pagell, 2004).

Team objectives and member predispositions toward manufacturing or marketing may cause the team to emphasize one area over the other. For instance, team composition may result in a bias towards stressing the importance of product differentiation to the detriment of operations complexity (Krishnan and Ulrich, 2001). Indeed, manufacturing is often perceived as less important than marketing for business success (Hausman et al., 2002). Teams with such an emphasis may have high levels of marketing agreement, but may develop strategies and make decisions detrimental to manufacturing competitiveness (Papke-Shields and Malhotra, 2001). Alternatively, teams could be manufacturing oriented, with an emphasis on controlling costs (Porter, 1985). Such teams may have high levels of manufacturing agreement and consequently direct their efforts towards understanding new developments in efficient manufacturing technologies (Zammuto, 1988) and miss important marketing opportunities. Agreement about only manufacturing or marketing engenders conflicts around how to achieve the overall manufacturing and marketing goals of the team, which may lead to less-than-optimal team performance (Hayes and Wheelwright, 1984).

The common tension between manufacturing and marketing, however, will be reduced if the team has balanced agreement of the business environment's manufacturing and marketing elements. Over time, this cross-functional agreement will generate common cognitive schemas and frameworks across the team (Weick, 1979; Spender and Grant, 1996), which can act as vehicles for molding, integrating, and reconciling different team members' comprehension of the manufacturing and marketing environment (Grant, 1996). This leads to greater ability for the operational team to recognize the value of new marketing and manufacturing information (White et al., 2003). When marketing decision-makers are perceived to be informed about manufacturing, they become more credible in the manufacturing decision-makers' eyes (and vice versa). The more credible team members are to each other, the more cooperatively they will act (Gupta and Wilemon, 1988). Thus, higher levels of both marketing and manufacturing agreement should promote more coordinated decisions that will be associated with improved team performance. Thus, in support of our second intended contribution:

H4. After controlling for marketing and manufacturing team-accuracy, higher levels of marketing team-agreement in the presence of higher levels of manufacturing team-agreement is associated with improvements in team performance beyond those improvements associated with the main effects of marketing agreement and manufacturing agreement.

4. Research method

Following the lead of other organizational researchers (Croson and Donohue, 2006; Gattiker et al., 2007; Cantor and Macdonald, 2009; Kennedy et al., 2010), the data was collected using a business simulation designed to allow for the study of teams' situational awareness accuracy and agreement about the marketing and manufacturing environments - an area that has been noted as being difficult to study using conventional methods (Baker et al., 1997). Simulation methodology was chosen to allow for a stronger assessment of accuracy and agreement for three reasons. *First,* team awareness and accuracy are a cognitive aspect of managerial decision making (Bonney et al., 2016). Cognitive research requires that participants be caught "in the act of thinking" which can be difficult to measure. The use of simulation allowed us to capture the business awareness phenomenon during the functioning of the teams.

Second, prior research advocates for studying agreement and accuracy under pre-constructed scenarios which allow for some control over the environment to minimize the distractions that may contaminate the data, but are also not so controlled as to pre-ordain a particular agreement and accuracy pattern (Gaglio and Katz, 2001). *Third,* in comparison, simulations have been lauded for their ability to introduce real-world complexity while also providing some level of control over the study (Brehmer and Dorner, 1993; Gundlach and Cadotte, 1994; Gonzalez et al., 2005). Past studies that have tried to accomplish this balance have erred on the side of control by utilizing experimental designs that do not account for the complex nature of the business environment or do not capture a true conceptualization or understanding of the business environment (Shepherd and DeTienne, 2005). The use of simulations in the operations literature is infrequent yet not unprecedented. For example, the renowned "beer game" has been used extensively to study the effect of cognitive processing on shared forecasting information on retailer/supplier inventory levels (e.g., Sterman, 1989; Croson and Donohue, 2006). Given that team perceptual accuracy and agreement used herein are also cognitive based constructs, we feel that the use of a business simulation as a research context is justified.

The simulation used to collect the data for this study is called "*Marketplace*", which organizes participants into management teams and requires each team to start and operate a personal computer business enterprise through eight business cycles. As the simulation progresses, participants must be keenly aware of the external environment (competitor maneuverings, demand swings, etc.) in order to improve their firm's performance. Management teams must be able to assimilate this information and translate it into meaningful knowledge that informs decision making in support of the firm's strategy. The management teams, which ranged in size from 3 to 6 managers (mean = 4.6), have responsibility for various facets of business (VP of Marketing, VP of Manufacturing, etc.).

4.1. Sample and data collection

The sample for this study was comprised of MBA students from eight U.S. universities that participated in the Marketplace simulation (see Appendix A for an overview of the simulation). These eight participating universities ranged from a large public university in the Southeastern region to a small private college in the Midwestern region of the U.S. Each of the participating universities administered an assessment during a specific session of the simulation dedicated solely to the assessment. In total, 667 MBA students, representing 145 teams, participated in the simulation and completed the corresponding assessment. On average, the participated MBA students have approximately 5.56 years of work experience, of which 66 percent are males. In addition, we captured the nationality of the participants and coded the team with a non-native speaker of English with a number 1, otherwise 0. Among the 145 teams, 41 percent have at least one non-native speaker team members. We included these information as the control variables as detailed below. We believe that MBA students are suitable for our research for several reasons. *First*, MBA students are often utilized in simulation-based operations management research (Croson, 1996, 1999; Gattiker et al., 2007; Cantor and Macdonald, 2009; Kennedy et al., 2010). There is support for the notion that today's MBA students are tomorrow's business decision makers (Croson and Donohue, 2006). *Second*, research also shows that decisions made by business students do not differ appreciably from those made by managers (Remus, 1986; Sterman, 1989; Holweg and Bicheno, 2002; Machuca and Barajas, 2004; Croson and Donohue, 2006). *Third*, this sample provides a desirable control mechanism due to the relative homogeneity of the participants and the consistent course delivery setting (Lynch, 1983).

In this simulation, participants completed eight decision periods, each representing a three-month period (quarter). During the first three quarters, participants became familiar with the nuances of the business, the interaction with the software, and how to work with their teammates to make decisions. Administration of the assessment and data collection took place between quarters 4 and 5. Collecting data at this point in the simulation allowed participants to gain sufficient understanding of the simulation and the dynamics of teammates. Also, the administration of the assessment coincided with the teams' development of a year two business plan. This business plan outlines the strategic and tactical actions that teams intend to execute over the remaining four quarters of the simulation. In short, the assessment captures the team-accuracy and agreement at a time when the teams are engrossed with planning the strategic and tactical direction of the firm requiring substantial cognitive processing by the respective team members.

4.2. Measures

4.2.1. Independent variables

The independent variables in this research are *manufacturing and marketing team-accuracy and agreement.* As mentioned earlier, manufacturing and marketing team-accuracy is defined as the team members' perceptions and comprehension of the meaning of manufacturing- and marketing-related information, indicated by the ability of the team members to make both timely and correct predictions regarding likely future events in that environment. Manufacturing team-agreement is the degree to which team members have the same understanding of the manufacturing- and marketing-related environmental factors (Endsley and Jones, 2001).

In keeping with the definition advanced by Endsley (1995), accuracy and marketing agreement were conceptualized as consisting of three dimensions: 1) a team's ability to perceive key elements of the business environment, 2) comprehend the key elements' meaning and 3) predict their decision impact on the business environment going forward. In support of our third intended contribution, accuracy and agreement were objectively operationalized as the team's ability to 1) recall critical market elements such as sales volume (*perception*), 2) understand team performance relative to competitors (*comprehension*), and 3) predict future events in the market (*prediction*). In order to measure this variable, a survey instrument was developed to specifically assess team members' understanding of the market, which was tailored after the operationalizations of the awareness dimensions found in military contexts (Endsley, 1995b). Table 1 provides a list of sample survey questions. In developing this survey instrument, three rounds of pre-testing were conducted at three major public universities using a total of 480 MBA and undergraduate students. These pre-tests and evaluation procedures yielded a final battery of 31 questions (11 manufacturing and 20 marketing) that reflect the three dimensions of accuracy and agreement.

Team-accuracy is defined as the team members' perception and comprehension of the meaning of information related to the business environments, leading to the ability to make both timely and correct predictions regarding likely future events (Endsley, 1995a). The first dimension of accuracy is *perception*, which entails the team members' ability to notice important elements in the business environment. Adhering to prior operationalizations of team-accuracy which require basic recall about the state of the business environment, simulation participants in this study were asked questions pertaining to the manufacturing and marketing aspects of the environment. Specifically, team members were asked to recall current, pertinent competitor and industry information (e.g., brand strength, sales volume) that was provided in Marketplace's market reports and financial statements. The accuracy of each response was determined by comparing individual's answers to the "actual" conditions of the firm and market.

The second dimension of team-accuracy is *comprehension* which involves integrating various pieces of information to arrive at some level of understanding (Endsley, 1995b). In the situational awareness literature, participants are often asked to make a determination of strengths and weaknesses based on elements that are perceived in the environment as a means of assessing comprehension (Endsley, 1995b). In a

Table 1
Team-awareness and agreement survey questions[a].

Team-awareness examples
Perception:
• Which company had the lowest average production cost across all brands?
• Which market region contributed the most to the company's bottom-line profitability?
Comprehension:
• Our ability to compete on price was a (strength or weakness)?
• Our aggressiveness in hiring new sales representatives was a (strength or weakness)?
Prediction:
• Which firm will have the lowest average price in the next quarter?
• Which firm will have the greatest fixed capacity in the next quarter?
• Our ability to compete on price will be a (strength or weakness) in the next quarter?
Team-agreement examples
When it comes to R&D, we should …
• Invest in a limited set of R&D projects that will provide high returns over the remaining quarters
• Invest heavily in a wide range of new technologies
• Partner with competitors to share development costs at the risk giving away our future strategies and tactics
• Both invest heavily and partner with other firms to maximize the technologies available for our products
When it comes to managing production, we should …
• Aggressively pursue lean, flexible manufacturing - invest heavily to minimize changeovers
• Improve efficiently by limiting the number of brands
• Reduce brand features in order to lower per unit production costs

[a] The entire list of survey questions is not publishable due to copyright issues with the developer of the "Marketplace", but available upon request.

similar fashion, a set of questions was developed to determine if Marketplace participants could integrate the information available in the reports and financial documents to make accurate conclusions about functional aspects of their company being strengths or weaknesses. It is important to note that the answers to these questions are not directly available from Marketplace reports like those from the perception dimension; participants had to think through different aspects of the environment to arrive at the correct conclusion. For scoring purposes, weaknesses (strengths) were judged based on whether the focal firm was below (above) the industry average where appropriate.

Finally, the *projection* dimension of team-accuracy refers to the ability to predict the status and location of environmental elements in the future. Again, following prior operationalizations, participants in the current study were asked to predict manufacturing and marketing outcomes in future periods. The questions also assessed how much the participants could project what would happen to their own firm in the next time period. As with the comprehension dimension, the answers to these questions were not available in Marketplace reports given the nature of the questions and because the answers could only be determined after the events of the next time period played out. For scoring, each person's projection skills were assessed by comparing their predictions to the actual events that were revealed when the simulation advanced to the next period of operation.

As alluded to, each of the 31 measures has an objectively correct answer, allowing for the calculation of an accuracy score for each team on both manufacturing and marketing understanding of the business environment. Team members were awarded 10 points for every question that was answered correctly - the Marketplace software scored the assessment automatically. In order to calculate a team-level accuracy score, all team members' accuracy scores were summed and then divided by the number of participants on the team to arrive at an average of each team's manufacturing and marketing accuracy (means = 98.62 and 61.85, respectively).

Team-agreement is the degree to which team members have the same understanding of environmental factors (Endsley and Jones, 2001). While the team-accuracy measure is focused on the extent to which team members were correct in their understanding of their business environment, the agreement measure considers the extent to which team members were in agreement with each another. Specifically, we captured both the manufacturing and marketing team-agreement. For example, team members answered manufacturing-related questions (manufacturing team-agreement) such as "*when it comes to managing production, which of the following tactic should we conduct?*" The answers are then compare and calculated using a paired comparison method (Rentsch and Klimoski, 2001) across the team members. The goal was to obtain a composite measure of the level of manufacturing and marketing agreement across all members of each team. In the current sample, as shown in Table 2, respective team members were in agreement on the manufacturing related items 47% of the time and on marketing related items 56% of the time (means = 0.47 and 0.56, respectively).

4.2.2. Dependent variable

The dependent variable in this research is team-performance. During simulation, teams receive a myriad of performance reports used to support decision making. The primary goal of participants is to maximize their team score on a balanced scorecard, which represents an index of a variety of performance metrics. The objective criteria used to calculate the balanced scorecard includes measures of financial performance, marketing effectiveness, investments in the future, asset management, manufacturing productivity, creation of wealth, human resource management, and financial risk. Specifically, the measure of performance was a cumulative balanced scorecard (CBSC) following the eighth and final decision period. The CBSC is formed as an average of the team's balanced scorecards for quarters 5 through 8. The advantage of CBSC is that it reduces the effect of extremes in performance over these four decision periods. Also, all of the grading schemes used by the course instructors use the CBSC for grading purposes meaning that participants are "managing" to this measure of performance. As detailed in Table 2, the average score for teams in the current sample was 187.63 (SD = 469.03). As a robustness check, we also used manufacturing productivity as an alternative dependent variable to ensure reliability of our analysis. The results remain consistent and are elaborated in the robustness check section below.

4.2.3. Control variables

We included three control variables in our research model – game identifier, participants' work experience, and whether a team contained a non-native speaker of English or not (Ta et al., 2018). Specifically, the game identifier ensures that teams are competing against only those teams that are in their respective class section. In the current sample, there were 34 separate game sections. As for work experience, we captured each participants' work experience in years, then averaged it for each team (mean = 5.56). Lastly, we controlled for the nationality of the participants by coding teams with non-native speakers with 1, otherwise 0. Out of the 145 teams, 60 teams have one non-native speaker as a team member, while 85 teams are formed by native speakers only. Table 2 provides descriptive statistics for all variables included in our hypothesized model.

5. Results

A hierarchical regression model was used to test the effects of manufacturing and marketing team-accuracy and agreement as well as their interactive effects on overall team performance (Cohen and Cohen, 1975). Using this technique allowed for a more accurate assessment of the respective and incremental effects of various accuracy and agreement constructs studied. We argue that for team-agreement to be useful to decision makers, it must first be accurate. This is especially important to our study. We are interested in examining the incremental effect of agreement, after controlling for the effect of accuracy, to ascertain if

Table 2
Means, standard deviation and correlations.

Variables	Mean	SD	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) Team Performance	187.63	469.03								
(2) Marketing Accuracy	98.62	21.99	0.32***							
(3) Manufacturing Accuracy	61.85	14.37	**							
0.26	0.22**									
(4) Marketing Agreement	0.56	0.09	**							
0.24	**									
0.55	0.30***									
(5) Manufacturing Agreement	0.47	0.13	0.22**	**						
0.24	0.55***	0.42***								
(6) Game Identifier	18.48	9.77	−0.17*	−0.08	−0.17*	*				
−0.14	−0.10									
(7) Work Experience	5.56	4.42	0.23	0.08	0.13*	0.13*	0.25	−0.31***		
(8) International Team Member	0.41	0.49	0.05	0.08	0.07	0.04	−0.46	0.01***	−0.02	(−)

Note: N = 145 teams, *p < 0.05, **p < 0.01, ***p < 0.001.
International team member is a dummy variable - with a non-additive speaker team member is coded as 1, with only native speaker is coded as 0.

agreement explains any additional variance in team performance beyond that accounted for by accuracy.

Table 3 provides the results of the hypotheses. In Step 1, all control variables are introduced in the regression model. Step 2 provides a test of $H1_{a,b}$. H1 suggested that team performance is positively associated with team-accuracy. As detailed in Table 3 (step 2), manufacturing team-accuracy exhibited a positive, significant relationship with team performance ($\beta = 0.16$, $P < 0.05$). This provides support for $H1_{a,}$ team performance is positively associated with manufacturing team-accuracy. Similarly, Step 2 also shows that marketing team-accuracy was significantly positively related to team performance ($\beta = 0.26$, $P < 0.001$), providing support for $H1_b$ which states that team performance is positively associated with marketing team-accuracy.

H2 suggested that the two types of accuracy would interact and have a positive effect on team performance. This hypothesis was also supported as shown in the Step 3 of Table 3. Specifically, after controlling for the main effects of manufacturing and marketing accuracy, we find that the interaction of the two accuracy constructs has a positive relationship with team performance ($\beta = 0.22$, $P < 0.01$), in support of H2. This result indicates that with high marketing and manufacturing team-accuracy, team performance will be optimized. It is necessary to consider both types of accuracy for a holistic understating of team performance.

Table 3
Hierarchical regression analysis.

DV: Team Performance	*Step 1*	*Step 2*	*Step 3*	*Step 4*	*Step 5*
Game Identifier	−0.09	−0.06	−0.05	−0.05	−0.06
	(4.07)	(3.89)	(3.79)	(3.84)	(3.76)
Work Experience	0.24***	0.21***	0.207***	0.20**	0.16*
	(8.98)	(8.54)	(8.32)	(8.58)	(8.55)
International	0.06	0.02	0.05	0.05	0.05
Team Member	(76.53)	(72.80)	(71.50)	(72.42)	(70.92)
Marketing		0.26***	0.28***	0.27**	0.27**
Accuracy		(1.68)	(1.64)	(1.93)	(1.89)
Manufacturing		0.16*	0.14*	0.12	0.12
Accuracy		(2.60)	(2.54)	(3.00)	(2.94)
Mkt*Mfg			0.22**	0.22**	0.15*
Accuracy			(0.11)	(0.11)	(0.11)
Marketing				0.18	0.04
Agreement				(507.87)	(499.13)
Manufacturing				0.18	0.12
Agreement				(364.63)	(360.25)
Mkt*Mfg					0.21**
Agreement					(3115.01)
N	145	145	145	145	145
F	4.285***	9.228***	8.434***	1.048*	6.831***
Df	141	139	138	136	135
R^2	0.084	0.191	0.238	0.240	0.280
Adjusted R^2	0.064	0.162	0.204	0.193	0.226
Change in R^2		0.107***	0.047***	0.002*	0.040***

Note: *p < 0.05, **p < 0.01, ***p < 0.001. Robust standard errors in parentheses.

Multicollinearity could be a concern when investigating the interaction effect in regression models. We first tested the variance inflation factor (VIF) for each variable to determine whether multicollinearity is an issue. The VIF values between the independent variables ranged from 1.45 to 1.65, indicating that multicollinearity was not a concern.[1] Furthermore, we graphed the interaction results, shown in Fig. 3, suggesting that teams possessing an accurate understanding of manufacturing and marketing business environment make better decisions and experience superior performance.

In order to test $H3_{a,b}$, we assessed the unique variance explained by manufacturing and marketing team-agreement within Step 4. $H3_{a,b}$ indicate that team performance is positively associated with manufacturing and marketing team-agreement. As detailed in Table 3, after controlling for the respective effects of accuracy and their interaction, neither manufacturing nor marketing team-agreement explained a significant amount of unique variance in team performance ($\beta = 0.18$ and 0.18, respectively). Unfortunately, neither $H3_a$ nor $H3_b$ were supported. Finally, to test H4, the interaction of manufacturing and marketing agreement was introduced in Step 5. Although the direct impacts of manufacturing and marketing team-agreement on team performance were not statistically significant, it was necessary to test the interaction effect of these two factors. The interaction effect could reflect a more holistic picture in that it took both team-agreements into consideration. As shown in Table 3, after considering the effects of accuracy and the main effects of manufacturing and marketing agreement, a positive relationship exists between team performance and the interaction of manufacturing and marketing agreement ($\beta = .21$, $P < 0.01$). This supports H4. Fig. 4 highlights that team performance is enhanced when agreement is exhibited in both manufacturing and marketing. On the other hand, having agreement in either manufacturing or marketing, but not both, is associated with significantly degraded team performance. In summary, as depicted in Fig. 2, $H1_a$, $H1_b$, H2, and H4 were supported while $H3_a$ and $H3_b$ were not supported.

5.1. Robustness check

To ensure the robustness of our research model and data analysis, we conducted an additional robustness check with an alternative dependent variable – manufacturing productivity. Manufacturing productivity has been used as a conventional OSCM indicator in prior literature (e.g.

[1] We also followed the traditional analysis approach by mean-centered the independent variables prior to forming the interaction terms to reduce multicollinearity (Aiken and West, 1991). The results remain the same.

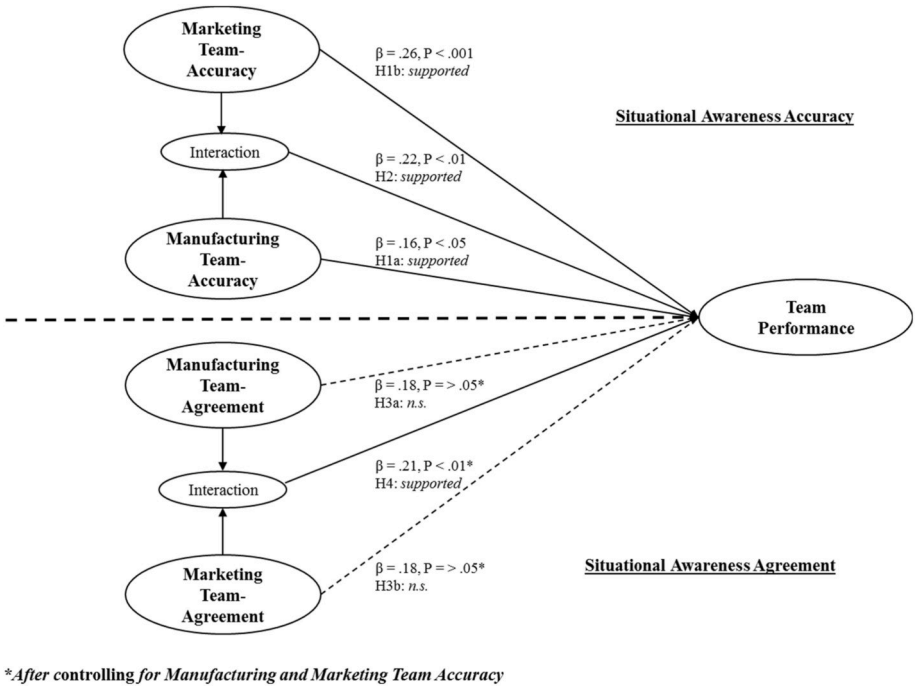


Fig. 2. Model results.

Fig. 3. Interaction between manufacturing and marketing team-accuracy in predicting team performance.

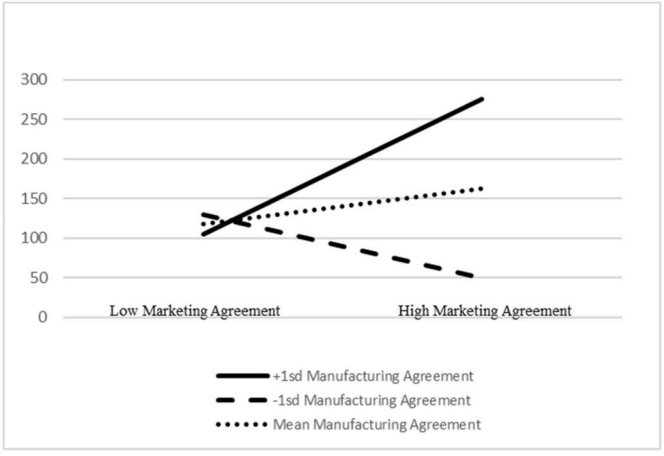


Fig. 4. Interaction between manufacturing and marketing team-agreement in predicting team performance.

Abolhassani et al., 2019; Friesike et al., 2019) and is one of the key measures of a company's internal supply chain function. The robustness check results are detailed in Table 4. Specifically, we found statistically significant relationships between manufacturing, marketing team-accuracy and manufacturing productivity, supporting H1a and b ($\beta = 0.25$, $P < 0.01$; $\beta = 0.17$, $P < 0.05$ respectively). In addition, there was a positive and significant interaction effect of the two types of accuracy on team performance ($\beta = 0.07$, $P < 0.05$), indicating H2 is supported. Same as the main analysis, we did not find statistically significant relationship between the manufacturing, marketing team-agreement on team performance. H3 a and b are not supported. However, the interaction effect of the team-agreement remained significant ($\beta = 0.10$, $P < 0.05$). In conclusion, the results of the robustness check are consistent with the main analysis.

6. Discussion

Our research model suggests that when team members have accurate and less conflicting interpretation of their current business environment – i.e. high situational awareness – team performance increases. Our findings confirmed that team members' situational awareness of both the manufacturing and marketing business environments function as the antecedent of team performance. This study extends existing theory and suggests a number of important practical considerations for intrefunctional teams involved in manufacturing and marketing strategy formulation.

6.1. Implications for theory and research

Our results suggest that teams with an accurate understanding of both environments are more likely to make effective decisions and achieve superior performance. Specifically, the results suggest that team

Table 4
Robustness check with alternative DV

DV: Productivity	*Step 1*	*Step 2*	*Step 3*	*Step 4*	*Step 5*
Game Identifier	0.01	0.56	0.06	0.05	0.05
	(0.03)	(0.00)	(0.00)	(0.00)	(0.00)
Work Experience	0.04	0.01	0.01	0.04	0.05
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
International Member	0.10	0.06	0.06	0.05	0.05
	(0.00)	(0.02)	(0.02)	(0.02)	(0.02)
Marketing Accuracy		0.17*	0.17*	0.26**	0.26**
		(0.00)	(0.00)	(0.00)	(0.00)
Manufacturing Accuracy		0.25**	0.25***	0.32**	0.32**
		(0.00)	(0.00)	(0.00)	(0.00)
Mkt*Mfg Accuracy			0.07*	0.07	0.04
			(0.00)	(0.00)	(0.00)
Marketing Agreement				−0.16	−0.17
				(0.16)	(0.16)
Manufacturing Agreement				−0.07	−0.05
				(0.11)	(0.11)
Mkt*Mfg Agreement					0.10*
					(0.98)
N	145	145	145	145	145
F	0.560	3.629***	3.137**	2.857**	2.687**
Df	141	139	138	136	135
R^2	0.012	0.115	0.120	0.144	0.152
Adjusted R^2	−0.009	0.084	0.082	0.094	0.095
Change in R^2		0.104***	0.005	0.024*	0.008*

Note: *p < 0.05, **p < 0.01, ***p < 0.001. Robust standard errors in parentheses.

performance improves when manufacturing or marketing business environments are accurately assessed which is consistent with situational awareness theory. In addition, when teams have an accurate understanding of *both* the manufacturing *and* marketing environment, there is an additional positive impact on team performance, as shown by the interaction effect of manufacturing and marketing team-accuracy. This finding extends prior research on the use and impact of knowledge in coordinating manufacturing and marketing decisions (O'Leary-Kelly and Flores, 2002). Much of this existing research was conducted from a functional perspective, for example, assessing marketing's knowledge of manufacturing processes and manufacturing's evaluation of marketing's interactions with customers (Calantone et al., 2002).

Previous operations and marketing research addressed the importance of capturing and assimilating accurate information about the business environment (Craighead et al., 2009), and has more recently begun to recognize the value of teams to enable this process (Hoegl et al., 2003). Other operations management research acknowledges that organizational members must go beyond simply "throwing information over the wall" and instead develop a shared understanding and agreement of functionally-specific information in order to drive unified strategy and decision making (Wall et al., 2004). By adopting a situational awareness "lens" through which to view team members' understanding of manufacturing and marketing business environments, this research proposes that a team's ability to accurately understand and agree on the manufacturing and marketing business environment is associated with improved team.

In particular, the results suggest that even if the team's manufacturing or marketing understanding is accurate, there is no additional team performance associated with improved agreement about *either* the manufacturing *or* marketing environment separately. However, the results highlighted here suggest **that** teams improve their performance when they agree on *both* the manufacturing *and* marketing environment, measured by the interaction term of manufacturing and marketing team-agreement. Depending on team characteristics, a team may be more manufacturing-oriented (e.g. focusing on the impact of competitor actions' on industry supply capacity) or marketing-oriented (e.g. focusing on competitor actions' impact on customer preferences) (Pagell and LePine, 2002; Miles and Snow, 2007). The implications of this finding are that teams with a myopic functional orientation may create misalignment and conflicts between external/customer activities and internal/process activities. As mentioned earlier, these effects are after controlling for the effects of accuracy held by team members. Accordingly, these relationships represent the unique effect of teams possessing an agreement of both the manufacturing and marketing environment beyond the positive effects of possessing an accurate understanding of such environments. These findings highlight the importance of agreement about the state of both the manufacturing and marketing environment to facilitate coordinated customer-operations decisions. Further, the e**xisting manufacturing and marketing research on shared interpretation of information** (Hult et al., 2004; Fugate et al., 2009) has only included agreement about the *current* environment. T**he integration of the situational awareness theory extends theory by capturing objective agreement about projections of the *future* environment. Such agreement is critical as the marketing and manufacturing decisions will likely improve if they are made based on informed foresight about the future.**

6.2. Implications for business practice

The implications of our results stress that decision makers of manufacturing and marketing teams should recognize the importance of accurately interpreting incoming information from the business environment. More specifically, the use of perception, comprehension and projection in the conceptualization of team-accuracy and agreement illustrates that simply sharing and agreeing the basic facts about the manufacturing or marketing environment is necessary but insufficient condition for team success. Team members should take the time to help each other to reach an accurate understanding of how the firm is positioned against competitors based on the respective manufacturing and marketing environment (comprehension). Likewise, each of the functional areas should help members from other areas understand the likely state of the environment in future periods.

Our results suggest that manufacturing and marketing decisions will improve (e.g., production matching demand) when team members have an accurate understanding of *both* the manufacturing *and* marketing environments in addition to their own respective area of responsibility. Obtaining information of a narrow range of the external environment (of either manufacturing or marketing), even if accurate, may not allow the team to take full advantage of potential opportunities to better align production and demand. Teams involved in manufacturing and marketing decisions, therefore, must break through these functional biases by developing accurate representations of both environments.

In addition, management needs to be aware of the team performance implications resulting from conflicting interpretation and invest in training for employees that are positioned to acquire and interpret environmental information. Further, team leaders should consider conducting assessments similar to the assessment of team-accuracy and agreement discussed in this research. With respect to accuracy, the assessment would likely aid in the establishment of a team member's performance and associated areas for development. With respect to agreement, team member differences in environmental understanding might be appropriately used as an impetus for the team to pause for in-depth discussions before moving forward with manufacturing and marketing decisions.

6.3. Limitations and future research

With the ongoing shift of consumer-centric operational strategies and the importance of understanding intraorganizational team performance, this research naturally opens up numerous research opportunities. For example, when accuracy is highly fragmented across the team members (West, 2007), there is a potential for a single team member to provide idiosyncratic functional knowledge to the group decision making process. Our research does not account for this "specialist approach".

We measured team-accuracy as the total number of questions the team answered correctly. However, the specialist approach would account for the manufacturing or marketing functional nature of each question, positing that the marketing manager should score higher on the marketing related questions and the manufacturing manager should score higher on production related questions. While the findings discussed here suggest that the team as a whole should eventually possess a shared understanding of both the manufacturing and marketing environment, perhaps it is effective for functional specialists to be responsible for capturing accurate information about their respective environment and then share such information with all team members in order to reach a shared interpretation of both the manufacturing environment and marketing environment. Future research should test the generalist versus specialist perspectives and the effect that the specialist approach has on team performance.

Our research did not account for the impact of variables such as leadership on accuracy and agreement and team performance. We assumed equality among team members in terms of the contributions each made to the decision-making tasks. However, if a team had a particularly strong leader who coordinated the efforts of the other team members then the team as a whole may have had a low accuracy and agreement scores yet still achieved high firm performance. This begs the questions; how does strong leadership affect the accuracy and agreement constructs? Future research should seek to address this question.

Team-accuracy and agreement could be tested within the context of the supply chains, but within other functional areas (e.g. new product development) and buyer-supplier relationships. For instance, cross-functional customer-supplier teams are increasingly seen as an effective way to ensure quality and service, as well as to reduce costs (Trent and Monczka, 1998). By bringing the expertise of both organizations together, innovation can flourish, issues can be resolved quickly, and a focus on mutual success can be maintained (Trent, 2005). Accuracy and agreement are critical to achieving the objectives of these cross-functional customer-supplier teams, while also providing a platform for continued buyer-supplier relationship development.

Methodological improvements in future research of team-accuracy and agreement could be made by moving the research context to a field setting. Replication of the current study using managers engaged in real decision making would provide much improved generalizability to the theory tested in this research. The tradeoff would be that control over potentially biasing and confounding variables as well as the ability to objectively measure the accuracy and agreement variables would be greatly reduced but testing this research in the field would increase the generalizability of the hypothesized model.

In addition, using a simulation methodology provides a controlled setting for the investigation and objective measurement of team cognition variables (Cantor and Macdonald, 2009) yet limits the generalizability of the findings. While the 667 participants were MBA students and previous research suggests there are no differences in these type of students and practicing managers (Holweg and Bicheno, 2002; Machuca and Barajas, 2004; Croson and Donohue, 2006), the managerial implications should be taken with caution until further investigation of these constructs can be conducted in field settings and the findings replicated in even more realistic arenas.

The data for our research was collected at a single, albeit critical, point in time immediately following the midpoint of the simulation exercise. This form of data collection assumes that high levels of management team-accuracy and agreement in time period T were present in $T-1$ and will remain high in periods $T+1$. In other words, a static model was tested in the research that will not itself account for change in the accuracy and agreement over time. It is conceivable that the significant changes in the level of one or all of these variables could have an effect on the dependent variable in the study such that longitudinal data should be considered in future studies.

7. Conclusion

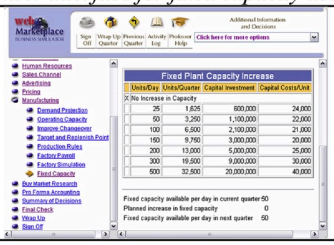
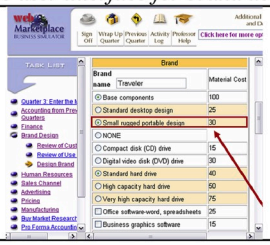
Recently, researchers and practitioners in operations and supply chain management are increasingly concerned about the conflicting paradigms and contradictory operational objectives in organizational design (Ehie, 2010). Based on the premise of the ongoing shift of consumer-centric operations and the importance of an internal integration between marketing and manufacturing functions, this study investigates an intraorganizational conflict between teams and highlights the importance of within and between teams' situational awareness accuracy and agreement. We conclude that cross-functional integration of marketing and manufacturing teams might be a precondition for better performance. Interestingly, the results show that it is not enough that each function accurately predicts their relevant external environments, it is the combination of team accuracy and agreement that generates the most superior performance.

Appendix A. Marketplace simulation overview

For detailed description of the *Marketplace* simulation, see http://www.marketplace-simulation.com/support/faq-web-team.html and for demos see http://marketplace-simulation.com/sample-screens/flash-demo.php.

Game Scenario: Teams are placed in a new venture scenario – starting up and running a new business. The opposition is played out by competing teams, who are entering the market at the same time. They are entering the international computer industry during its introductory stage of the product life cycle. Business decisions/scenarios are introduced as they become relevant in the evolution of the product life cycle, company, and global marketplace.

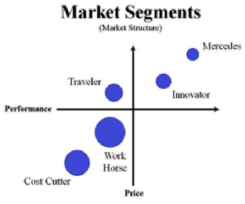
- *Decision scenario process:* Business team receives information on current situation, current situation is evaluated, strategy formulated, and tactics set in place – for each of the eight quarters (1) tactical decisions are fed into the simulator, along with decisions of opponents and then (2) results of decisions are fed back to business team (e.g., sales, costs, accounting/financing, customer/competitor reaction, quality, market growth). The business team can acquire information on what is happening in the marketplace, such as customer and competitor actions/reactions to market decisions. Current situation is re-evaluated, and strategy/tactics revised. Tactical decisions are again fed into simulator. This is repeated for eight quarters.
  - *Sample decisions:* choose target segments, design and establish brand prices/priorities, determine global factory locations, design advertising, hire sales/service personnel, select web marketing tactics, purchase market research, invest in fixed production capacity (plant size), schedule production, determine transportation, production (e.g., push/pull), and quality (e.g., inspections, variance studies) methods, seek investment from venture capitalists, etc.

Sample user interface for fixed capacity decisions:	*Sample user interface for brand design:*
	

- *Marketplace Activities and Assessment Administration:*

Q1: Organize - Organize the team and assign responsibilities.	**Q2: Set-up Shop** -Review Market Research --Set strategic direction -Set plant and sales locations -Brand Design	**Q3: Test Market** -Develop marketing plan -Forecast demand -Set production schedule	**Q4: Skillful Adjustment** -Review market research -Review financials -Adjust strategy and tactics
Q5: Invest in Future **-Prepare 1-yr business plan** -R&D and marketing plan decisions -Capital expenditures	**Q6: Expand and Improve** - Monitor the market and adjust accordingly	**Q7: Expand and Improve** - Monitor the market and adjust accordingly	**Q8: Expand and Improve** - Monitor the market and adjust accordingly

- *Market:* The global market is segmented into five segments based on performance and price – Cost Cutter, Work Horse, Traveler, Innovator, and Mercedes, with 20 potential sales offices and regional web centers (see figures to the right).



- *Performance evaluation:* A Balanced Scorecard is used to measure the (team) firm's performance. At the end of the exercise, each team is ranked in the order of performance for the total score. A letter grade is assigned depending upon the team's ranking and how close it is to the team(s) above or below it.

Balanced Scorecard is based on: **Financial Performance** (earnings per share), **Market Performance** (market shares in 2 target segments adjusted for unmet demand), **Marketing Effectiveness** (customer satisfaction with brand and advertising designs in 2 target segments plus unit sales per sales person), **Investments in the Future** (spending on new offices and research and development as percent of sales), **Creation of Wealth** (retained earnings/total investment), **Asset Management** (asset turnover adjusted for excess inventory), **Human Resource Management** (sales force and factory worker productivity), The **Final Score** is a single number which combines all of these factors.

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