











ments, we used frequency counts and percentages and the mode.

The research question pertained to the level of consensus among ERP manufacturing consultants as to the desirability and feasibility of critical success factors for ERP implementations. To answer the research question and subquestions, the critical success factors with the highest consensus on desirability were used to answer Subquestion 1. The critical success factors with the highest feasibility were used to answer Subquestion 2. The critical success factors with the highest consensus on both desirability and feasibility were used to answer the primary research question.

## 5 RESULTS

### 5.1 Panel Demographics

The following tables display aggregated demographic characteristics of the panelists. Table 1 indicates the age range of the panel of experts. The two major age groups, 45 to 54 and 55 to 64, indicate that individuals with years of experience in business management and leadership roles are typically those who lead ERP implementation projects in SMEs [42].

Table 1  
*Panelists' Age Range (N = 42)*

Age	N	%
21 and under	0	0.00
22 to 34	2	4.76
35 to 44	6	14.29
45 to 54	15	35.71
55 to 64	16	38.10
65 and over	3	7.14

The second characteristic of the panel of experts we assessed was gender. The demographic data showed a disproportionately large percentage of male panelists compared to female panelists. These results may reflect the gender gap in the manufacturing industry. Along with mining, construction, and agriculture, the manufacturing industry shows some of the highest levels of industrial segregation in the United States in terms of gender [70].

Table 2  
*Panelists' Gender (N = 42)*

Gender	N	%
Male	32	76.19
Female	10	23.81

The third panelist characteristic was years of experience.

Regarding the years of experience of the panelists, more than two thirds of the panelists had more than 10 years of ERP implementation experience. The data indicated that the expert panel had extensive ERP implementation experience and represented a tenured group of manufacturing consultants.

Table 3  
*Panelists' Years of Experience (N = 42)*

Years	N	%
5 to 10 years	8	19.05
11 to 15 years	22	52.38
16 to 20 years	4	9.52
21 years or more	8	19.05

The fourth panelist characteristic was highest education level. More than 80% (34) of the participants held a master's degree. One reason may be due to the financial, operational, and technological acumen required to implement an ERP solution successfully. As Jensen [71] noted, consultants are continually furthering their education to share their knowledge with clients during ERP implementations and organizational change initiatives.

Table 4  
*Panelists' Highest Education Level (N = 42)*

Education	N	%
High school diploma	0	0.00
Bachelor's degree	8	19.05
Master's degree	34	80.95
Doctoral degree	0	0.00

The fifth panelist characteristic was the number of implementations the participants completed in SMEs. Due to the nature of some of the screening questions that required the participants to have at least 5 years of experience implementing ERP solutions, roughly 85% of the participants had performed at least six implementations in SMEs.

Table 5  
*Participants' Implementations Completed in Small and Medium Manufacturing Environments (N = 42)*

Number of implementations	N	%
1 to 5	6	14.29
6 to 10	18	42.86
11 to 15	7	16.67
16 to 20	6	14.29
20 or more	5	11.90

The sixth panelist characteristic was the participants' geographic region. With the highest percentage of panelists implementing ERP solutions in the Midwest, the data show that manufacturing organizations in this region of the United States are still investing in their operations, although researchers have noted declines in production in the industrial Midwest [72].

Table 6  
*Participants' Geographic Region (N = 42)*

Region	N	%
Northeast	11	26.19
Midwest	13	30.95
Southeast	6	14.29
Southwest	4	9.52
West	8	19.05

### 5.2 Narrative Results

Out of the 18 narrative responses received, five common themes were identified: (a) rewards and recognition, (b) realistic project scope, (c) extensive testing and sign-off (d) defined roles and responsibilities, and (e) extensive end-user training. Due to the high frequencies of the rated critical success factors in the survey, the suggested critical success factors were not moved to Round 2.

### 5.3 Internal Consistency Reliability

Upon completing Round 2, Cronbach's alpha was used to test the internal consistency reliability of the multipoint Likert scale. In this round, the value of 0.8 exceeded the acceptable reliability coefficient of 0.7 [67]. Cronbach's alpha measure indicated that overall, the Round 2 survey items were 80% reliable for rating the desirability and feasibility of the critical success factors identified in the study. Because Cronbach's alpha does not measure consistency and stability over time, Cronbach's alpha was also used to test internal reliability in Round 3 [73].

In Round 3, the remaining eight critical success factors were analyzed. Referring back to the initial plan to include the median score with the percentage agreement, the median score became the tie-breaker for the research question and both subquestions. In reviewing Cronbach's alpha, similar to

Round 2, overall the Round 3 items were 80% reliable for rating the desirability and feasibility of the critical success factors.

### 5.4 Round 1

The responses indicated that quality management and detailed data migration plan and readiness were the most desirable critical success factors followed by top management support and commitment. The panelists reached 100% consensus in regard to desirability on quality management, detailed data migration plan and readiness, and top management support. Of the 22 most desirable critical success factors rated in Round 1, the critical success factors moved to Round 2 were: (a) cultural change readiness, (b) top management support and commitment, (c) ERP fit with the organization, (d) business process reengineering, (e) quality management, (f) detailed data migration plan, (g) small internal team of the best employees, (h) open and honest communication, (i) contingency plans, and (j) user feedback usage.

### 5.5 Round 2

Based on the results of the analysis of the Round 2 data, only the top two percentages of 75% or higher on both the desirability and feasibility scales were moved to Round 3. As in Round 1, top management support and commitment was the critical success factor with the highest consensus. When including feasibility in the survey, the consensus increased for the two factors of ERP fit in the organization and small internal team of the best employees. These two factors are directly connected to the top management support and commitment factor as leadership decisions directly affect the selection of the ERP application and the forming of the project teams for the implementation.

### 5.5 Round 3

All of the eight critical success factors met the threshold for inclusion in the final list of critical success factors. Table 11 shows the results of Round 3. The consensus as to the desirability and feasibility of the top critical success factor of top management support and commitment remained the same throughout all rounds of the study. Also, similar to Round 2, ERP fit with the organization was of the highest rated critical success factors in Round 3.

### 5.6 Consensus Reached

Research Subquestion 1 pertained to the level of desirability of critical success factors in ERP implementations. The original cutoff for consensus was set at 75% based on the literature [64]; however, because there was a high level of consensus for all eight critical success factors, we increased the cutoff to 90%. The panelists reached 90% consensus on the level of desirability of the following five critical success factors: (a) cultural change readiness, (b) top management support and commitment, (c) ERP fit with the organization, (d) quality management, and (e) a small internal team of the best employees. The panelists reached 100% consensus on desirability for both top management support and commitment and ERP fit with the organization. Top management support and commitment had the highest median of 5.00, resulting in the factor with the highest level of

consensus on desirability.

Research Subquestion 2 pertained to the level of feasibility of critical success factors in ERP implementations. As with desirability, the panelists reached 100% consensus on feasibility for both top management support and commitment and ERP fit with the organization. The median score was 5.00 for top management support and commitment, indicating this factor had the highest level of consensus for feasibility. Consistent with the approach used for desirability, we increased the cutoff for consensus on feasibility to 90%. The panelists reached 90% consensus on feasibility of the following four critical success factors: (a) top management support and commitment, (b) ERP fit with the organization, (c) quality management, and (d) a small internal team of the best employees.

The primary research question pertained to the level of desirability and feasibility of critical success factors in ERP implementations. The four critical success factors on which the expert panelists reached 90% consensus on the levels of desirability and feasibility are: (a) top management support and commitment, (b) ERP fit with the organization, (c) quality management, and (d) a small internal team of the best employees. Top management support and commitment was the critical success factor with the highest consensus for desirability and feasibility, followed closely by ERP fit with the organization.

## 6 DISCUSSION

The responses from the expert panel of manufacturing consultants align with the body of literature. Leadership support is a CSF on which many researchers have reached a consensus [12], [74]. The panel of ERP manufacturing experts found it desirable and feasible to have top management support and commitment to successfully implement a solution in SMEs. In defining top management support and commitment as the company-wide support of empowered decision makers, leaders should not view an ERP implementation as a technology project; rather, they should view it as a strategic company initiative. Although the study results converge with the body of literature, researchers have differing views on leadership approaches to implement during times of organizational change.

Although cultural change readiness met the minimum level of desirability, this CSF did not meet the minimum feasibility criteria in the final round; however, cultural change readiness was also aligned with top management support and commitment. Leaders may need to assess the risks associated with large organizational changes as well as undertake a cultural assessment before embarking on a large project. Because the level of change involved in an ERP implementation, some leaders encounter resistance from their workforce, which may require a change in leadership approach [28], [61]. Leadership effectiveness increases the probability of an organization to change [75]. Researchers have stated that there is not a "one-size-fits-all" change management approach [76]. Although many researchers have argued for transformational leadership as the preferred approach over transactional leadership [77], transactional leadership still has its place in organizational environments.

In some business environments, employees will be

empowered by the transformational leadership characteristics the project provides through the means of decision-making opportunities [28], while other employee populations will look to be rewarded for participating in the change initiative [20]. Cullinane, Bosak, Flood, and Demerouti [78] stated that standardized, lean practices could lead to reduced job enrichment and engagement among employees. Maas et al. [18] argued against Cullinane et al.'s finding by indicating that reduced job enrichment and engagement could be mitigated by engaging employees in the implementation of these business process reengineering and lean initiatives. Validating Maas et al.'s finding, Chow [79] found that employees are empowered and motivated to make a positive impact on the organization, leading to increased innovation and creativity in the workplace.

### 6.1 Small Internal Team of the Best Employees

In creating cross-functional teams of the organization's best employees, leaders can harness the innovative thoughts of the employee base to build ideas organically and create a knowledge-sharing environment. The literature indicates that having a servant leadership style can enable leaders to help employees contribute to the overall organizational vision [80]. Researchers have found that servant leaders are more empathetic and incorporate EI, which enables them to enhance their leadership competencies by promoting the strengths of others [81]. In tying the small internal team of the organization's best employees with open and transparent communication, employee decision-making can be increased by developing communication channels of information. In providing these small teams with tools to be successful, leaders can assist their employees in making decisions that benefit all parties, including the organization by displaying open, honest communication.

When composing a group of the organization's best employees, leaders could also assess the leadership competencies of each group member. Shared leadership enables team members to express their different abilities and opinion in a decision-making process, enabling different decision-making styles to be demonstrated by individuals [82]. By instituting shared leadership practices, leaders of organizations can increase the trust, collaboration, and autonomy among team members, even after a project or initiative is complete.

### 6.2 ERP Fit with the Organization

Technology has enabled increased communication and visibility among organizations, resulting in a shift in managerial approaches to remain competitive in their respective markets. Current study findings align with the literature. In a survey of 169 IT leaders regarding users' resistance to enterprise applications, Joia et al. [20] concluded that leaders could mitigate this resistance by ensuring that the applications are well designed, are easy to use, and have simple interfaces. To ensure ERP fit within an organization, leaders and software providers have incorporated collective intelligence by creating new functionality within the new ERP application. This collaborative approach has led to increased user satisfaction and adoption of the new technology.

When culture is perceived as organizational core values, assumptions, and interpretations, the link between employees and culture is apparent [27]. Leaders may introduce strategies and goals, but followers refine and make the strategies rele-



vant. Leaders who can adapt this form of thinking will attribute organizational success to positive group norms and will form normative ties with employees [28]. In the body of research literature, although the leadership approaches have been successfully implemented in a variety of environments, the selected approach depends upon the objective.

Trust, an often-overlooked component to successfully implement change, is a critical factor among all stakeholders. For effective relationships to be created, nurtured, and propagated, trust must be distributed within the organization to build team spirit by demonstrating open and transparent communication throughout the project lifecycle. Leaders should foster an atmosphere in which trust and respect thrive and innovation flourishes in building a learning organization which is necessary for sustainable development. To make a positive impact on the corporation's environment and community, leaders of organizations must first assess the key variables for success before acting upon the organizational change initiative.

### 6.3 Quality Management and a Detailed Migration Plan

The current study findings converge with the literature. To address the issue that technological fit alone will lead to a competitive advantage for leaders of organizations, Goodhue and Thompson [83] created a task-technology fit (TTF) model to ensure a positive influence on individual performance. Goodhue and Thompson created an instrument to measure eight factors: (a) data quality, (b) locatability, (c) authorization, (d) compatibility, (e) timeliness, (f) reliability, (g) ease of training, and (h) relationship. The current study findings about the critical success factors of detailed data migration plan and quality management fit into the data quality factor Goodhue and Thompson measured.

Tripathi and Jigesh [84] used the TTF model to evaluate the fit and adoption of a cloud computing solution in an organization, concluding that if leaders of organizations institute a detailed data migration plan that includes audits throughout the data cleansing and conversion process, users of the organization could incur a high level of data quality in the business application, resulting in an increase in productivity. Although the TTF model has been modified or used in conjunction with other models such as technology acceptance model (TAM) and the unified theory of acceptance and use of technology (UTAUT) model, researchers continue to use the TTF model in studies to measure system fit, usage, and performance in the workplace.

Of the eight critical success factors rated for desirability and feasibility in the final round, only two focused on the technological aspect: ERP fit with the organization and a detailed migration plan. Given the remaining six factors – cultural change readiness, ERP fit with the organization, business process reengineering, quality management, a small team of the best employees, and open and transparent communication – focused on people or process, the current study findings could have a positive influence on social change by applying these critical success factors to any organizational change initiative.

## 7 LIMITATIONS AND RECOMMENDATIONS

### 7.1 Limitations

Due to the iterative nature of Delphi studies, attrition is always a risk. Although there were no indications that the panelists dropped out of the study due to its duration, the voluntary nature of the study limited understanding the reasons panelists dropped out of subsequent rounds of the study. Another limitation of the study was the original consensus threshold, which was set at 75% based on the literature [64]. The high level of consensus for the eight critical success factors in Round 3 led to increasing the cutoff to 90% for desirability and feasibility to determine which critical success factors were the most desirable and feasible among the panelists.

Although the panelists met the selection criteria, the selection of ERP manufacturing consultants could have been too narrow of a scope. Given individuals such as project managers may have previous consulting experience, the blending of the consulting and project manager roles in the study may have provided a different perspective, resulting in the identification of new critical success factors in Round 1. Additionally, the self-selected expert panel of ERP manufacturing consultants in the United States did not include ERP manufacturing consultants from any other geographical area. Selecting ERP manufacturing consultants from other geographical areas may have produced different results due to varying cultures, work environments, and leadership styles. García-Sánchez and Pérez-Bernal [85] found that in countries such as China and Mexico, leaders do not use decision support systems such as ERP applications; rather, leaders follow their cultural traditions of experience and intuition to make business decisions. With leaders in some countries facing difficulty implementing western technologies due to technological infrastructure or the skill level of the employee base, Avison and Malaurent [86] cautioned consultants and software vendors to be aware of cultural differences in other countries.

We used an established list of 22 consolidated critical success factors to conduct the survey. Although we allowed the expert panel of ERP manufacturing consultants to provide additional factors not outlined in the survey, there was the potential risk of influence given we provided the panelists with a list of critical success factors. Given the comments were not mandatory, the comments may not have reflected the thoughts of the panelists in the study. The methods used should be transferrable not only in ERP implementations, but for non-ERP projects as well such as LMSs or CRM applications.

### 7.2 Recommendations for Further Research

The Delphi study was limited by the experience and expertise of the panelists. The study is also limited by the application of a modified qualitative Delphi approach. This limitation could be addressed by implementing a quantitative or mixed methods Delphi approach, or a design different from Delphi. A quantitative or mixed methods approach for the current Delphi study could expand the scope of the panel to a more heterogeneous group, such as project managers, end users, and the organization's implementation teams. This approach may provide additional insight to the cultural or organizational challenges different groups face throughout the implementa-

tion lifecycle.

Christensen and Raynor [87] identified three purposes of theories: (a) to pinpoint causation, (b) to move toward predictability, and (c) to assist in analyzing successes and failures. Prior qualitative research has generated theories pertinent to organizational environments [88]. In the literature, the common theory cited among ERP critical success factors is DeLone and McLean's information systems (IS) success model [89]. The DeLone and McLean IS success model is the most adopted and most cited theory in information systems research [90]. DeLone and McLean [91] provided an update to their original model to respond to the change and progression that occurred across the IS landscape after the publication of their seminal work. Researchers have updated the DeLone and McLean model with various modifications to fit different information systems' environments and cultures. Along with DeLone and McLean's update to the model, other commonly cited studies focused on the respecification and extension of the DeLone and McLean success model. Although researchers who refuted the original model aimed to provide more theoretically sound studies, the DeLone and McLean model [89] continues to outperform the modified models [90], [91].

In addition to the various theories that have been used to measure ERP the success of ERP implementations in small and medium environments, many models were identified. Models such as petri nets, decision trees, fuzzy cognitive maps, and causal models have been used to measure critical success factors by modelling the interrelations with people, processes, and technology [52], but the balanced scorecard model was the most cited model in the literature [92]. Although it is used to monitor financial and business processes, the balanced scorecard model could be used in ERP implementations to align the vision, objectives, and measures of an organization throughout an ERP implementation lifecycle [92]. First introduced by Kaplan and Norton [93], the scorecard model could also be used in ERP implementations to define the multi-dimensional features and potential effects throughout the entire project lifecycle. Shen et al. [92] concluded that because the primary objective for a balanced scorecard is transform the visions of leaders of an organization into strategies and measures, using the balanced scorecard as a tool to build strategic processes, objectives, and measures takes a slightly different approach as successfully implementing ERP applications.

As the implementation base for ERP integrations such as blockchain technology continue to grow, the critical success factors outlined in this study may require reassessment for small and medium manufacturing enterprises. With this study focusing on internal commitment, collaboration, accountability, and trust, additional research may be required to assess the validity of existing critical success factors when an organization includes additional business partners and applications into the implementation.

Because small and medium enterprises make up a large portion of the employer firms in the United States, an additional analysis that focuses on this population may be required given their constraints compared to large enterprises. Small and medium enterprises may face greater challenges in adopting technology as compared to large enterprises [94]. Because most ERP research has been focused on large enterprises [17], [18], studies that focus on small and medium en-

terprises outside of the manufacturing industry may benefit other organizations. Given leaders of firms will most likely take part in only a few ERP implementations during their career, reviewing the results of firms regardless of industry may assist in alleviating potential issues that may arise during an implementation.

## 7.2 Recommendations for Application

The current study supported and expanded upon the literature on the critical success factors in ERP implementations in small and medium manufacturing enterprises. Researchers concluded when top management works closely with ERP users, the communication between business groups is enhanced, and conflict resolution becomes attainable [13]. Iveroth [95] stated that leaders of organizations should invest at least 50% of the budget of a technology project for establishing future state processes, training, education, and communication. To remain competitive in the market, firms must provide open, transparent communication and structures to spawn innovation. By maintaining close relationships internally as well as externally, all stakeholders involved will be able to assist in the innovation of the products and services of a technology and professional services organization.

Expert panelists in this study identified leadership competencies needed to successfully implement these applications. During ERP implementations, personnel within organizations require process changes, leadership, and change management. During this process, leaders should build learning organizations. Learning organizations are organizations with individuals who focus on: (a) a shared vision, (b) systems thinking, (c) mental models, (d) team learning, and (e) personal mastery [96]. In creating learning organizations during times of change, employees are empowered to learn, creating a larger probability for employees to embrace change. Additionally, learning organizations enable stakeholders to remain current on technological advances, providing benefits to both the individual and the organization [97]. Using these characteristics during times of change within an organization may provide immense benefits by harnessing innovative and creative ideas that can be implemented in new organizational processes and procedures.

With a decentralized decision-making model, the critical success factors identified in this study move outside of an organization's four walls [98]. With ERP blockchain integrations, transactions are visible to all network participants, increasing the auditability, trust, and increasing the confidence in the data [11]. As time and volume make the blockchain ledger more secure, more users within organizations may begin to transact immediate contracts, orders, and payments, essentially eliminating payment terms and increasing cash flow [30]. Similar to the introduction of cloud computing, 3-D printing, Industry 4.0, and IoT, it comes down to education and knowledge sharing of blockchain capabilities before it is universally adopted.

## 6 CONCLUSION

Although very little research has been performed on the topic, ERP applications can enable leaders to improve their triple bottom line (TBL). By providing visibility throughout a firm's

global supply chain, these applications can track the usage of raw materials and ensure all the firm's facilities are remaining environmentally responsible. For the people perspective of the TBL, researchers have found that the implementation phase of ERP applications have led to empowerment, job enrichment, and innovative behavior [18]. Finally, given ERP applications integrate the operational and financial functions of an organization, research has shown that 80% of the Fortune 500 companies have implemented these solutions for improved decision-making and higher profitability [18]. By leveraging ERP applications, leaders can promote positive social change by providing additional job opportunities and higher wages due to increased efficiencies.

While we focused on ERP implementations in small and medium manufacturing environments in this study, the results can have a positive impact on social change in other industries such as healthcare, hospitality, and education. Although the applications in these industries have different functions and serve different purposes, the critical success factors outlined in this study could also be applied to hospitality management systems, healthcare management systems, and learning management systems. Also, because the industries previously mentioned operate in different environments and cultures than manufacturers, the unconventional view of software implementations as it pertains to small and medium manufacturing could also lead to positive social change by viewing the software implementation through a different lens.

When embarking on a large endeavor such as an ERP implementation, leaders of organizations may encounter resistance when implementing change. These leaders should recognize ways employees could embrace change to mitigate the risk of failed implementations. With some organizations expanding across the country and the world, firms also experience differing environmental cultures. Latta [99] outlined the importance of identifying subcultures within an organization's system where resistance may arise. To validate this finding, an American manufacturer that expanded to Spain uncovered that out of the top five challenges within the new facility, employee resistance to change was tied for first along with the lack of technical knowledge of the employee base [100]. During times of change, employees look back on previous experiences, and poor change management history (PCMH) can influence employee perceptions of organizational change [100]. With this finding, leaders must look outside of conventional leadership methods to alleviate the risk of resistance. By becoming proactive in the identification of resistance, the adoption of change can uncover the advantages among stakeholders within the organization.

Trust is a critical factor among all stakeholders, yet it is often overlooked when implementing change. For effective relationships to be created, nurtured, and propagated, trust must be distributed within the organization to build team spirit [101]. Leaders should foster an atmosphere in which trust and respect thrive and innovation flourishes in building a learning organization which is necessary for sustainable development. To make a positive influence on the corporation's environment and community, leaders of organizations must first assess the key variables for success before acting upon the organizational change initiative.

Regardless of the approach, providing transparency at the

departmental level to gain buy-in to implement change at that level and will encourage input from lower level personnel during the change initiative. Once the change is rolled out at the organizational level, leaders can create a holistic, organic environment that leads to innovative actions and decision-making. When cultural change is perceived as an organization's core values, assumptions, and interpretations, the link between employees and culture is apparent. Leaders may introduce strategies and goals, but followers refine these strategies and make them relevant. Furthermore, leaders who can adapt this form of thinking will undoubtedly attribute organizational success to positive group norms and will form normative ties with employees [102]. In reviewing the literature, although the leadership approaches have been successfully implemented in a variety of environments, the selected approach depends upon the objective.

The goal of this modified Delphi study was to reach a consensus among a group of experts as to the desirability and feasibility of critical success factors in ERP implementations in the United States. Of the original 22 critical success factors in Round 1, the panel of experts reached 90% consensus on the level of desirability and feasibility on four critical success factors: (a) top management support and commitment, (b) ERP fit with the organization, (c) quality management, and (d) a small internal team of the best employees. Top management support and commitment had the highest consensus, followed closely by ERP fit with the organization.

Leaders typically refer to their cognitive abilities to make decisions, and ERP applications could assist them in making those decisions typically performed with the lack of information. Although many users utilize Excel spreadsheets and disparate systems, by installing a system that brings all data into one centralized application, leaders, teams, and departments would be able to collaborate, share data, and make better-informed decisions.

The results of the study are important to the fields of leadership and enterprise applications as the findings build on the body of knowledge for both disciplines. Regardless of the size of the organization, knowledge sharing is important both upstream and downstream. Leaders can benefit from this study to applying the new knowledge from this study within their organizations during times of change. Practitioners in the ERP industry can benefit from this study's findings by applying approaches outlined during ERP implementations to mitigate risk during these engagements.

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