

Article

Analytics Capability and Firm Performance in Supply Chain Organizations: The Role of Employees' Analytics Skills

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Abstract: Developing analytics capability has become one of the main priorities in organizations today. Despite the increasing use of analytics, the necessary conditions to obtain the expected benefits from such investment still need to be examined. Relying on information processing theory (OIPT), this study sheds some light on the requirements for properly utilizing analytics to receive the potential benefits in supply chain firms. Specifically, we study the role of supply chain process integration in developing analytics capability, and we further examine the role of analytics capability and employees' analytics skills in improving firm performance. Survey data collected from 240 supply chain top- and middle-level managers show that supply chain process integration enhances firms' analytics capability. However, analytics capability alone is not sufficient in improving firm performance; it must be complemented with employees' analytics skills. These findings extend the current literature on supply chain analytics and provide guidance and insights to supply chain managers for their analytics capability investments.

Keywords: analytics capability; supply chain process integration; firm performance; employees' analytics skills



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1. Introduction

Recently, data analytics has gained significant attention from both practitioners and academics. Many firms have attempted to incorporate analytics in order to improve their performance. According to reports, analytics is among the top priorities in organizations' agendas [1]. One of the areas that deploying analytics would have great impacts on is supply chain management [2]. According to a survey conducted by Accenture, more than one-third of surveyed organizations reported that they were starting to integrate data analytics in their supply chain management [3]. Despite the promising benefits of analytics for organizations, reports and studies show that many organizations still do not receive their expected outcomes from using analytics (e.g., [4–8]). A reason for this unsuccessful employment is that many organizations are not still completely familiar with the necessary conditions for utilizing data analytics effectively [9]. Existing evidence of the use of supply chain analytics is mostly anecdotal [10–13] or comprises cases and applications that are specific [14–16]. Hence, the use of analytics in supply chain management and the role of supply chain elements are still largely unknown.

To better understand the integration of analytics and supply chain elements, relying on organizational information processing theory (OIPT) [17–20], we examine the role of supply chain process integration and employees' analytics skills in improving analytics-based performance. Using OIPT, we examine the effects of lateral relations and vertical information systems on increasing the information processing capacity [19], which leads to enhancing the organization's performance. The current literature has mostly explored the technological aspects of analytics; hence, analytics capability has mainly been conceptualized as the ability to utilize tools and technology for processing data and gathering relevant

insights [21–23]. Following the study by Srinivasan and Swink [20], we use an expanded definition for analytics capability which includes “organization and process elements of analytics capability, positing that, from an organizational information processing theory perspective, processing large volumes and varieties of data is both a challenge and an opportunity” ([20], p. 1850).

This study has three main objectives: 1. follow the recent calls [10,24,25] and empirically test the role of data availability and integration in developing analytics capability, 2. extend the current literature on supply chain analytics by integrating supply chain elements and analytics capability, and 3. shed more light on existing inconsistencies in the academic and practical literature by suggesting a possible reason for situations in which companies may not receive expected benefits out of analytics investments. The empirical results from 240 supply chain managers show that integrating supply chain processes is a significant factor for increasing firms’ analytics capability. Interestingly, the results reveal that developing analytics capability alone cannot enhance firms’ performance; it must be integrated with employees’ skills. This finding suggests a possible reason for inconsistent findings regarding analytics investments and its impact on firms’ performance.

This research adds several insights to the existing analytics and supply chain literature. First, it diverts from the current technical focus of studying analytics to stress the importance of an organizational and process-oriented perspective in studying analytics capability. Second, responding to recent calls, it empirically tests the impact of the availability of data on analytics capability. The findings highlight the importance of supply chain process integration in developing analytics capability. This study is the first to show empirical evidence of associations between supply chain process integration, analytics capability, and employees’ skills, using data from 240 supply chain managers. Finally, this study tries to explain the inconsistent findings on the role of analytics in improving firm performance. According to our results, analytics capability cannot influence the firm performance by itself. The results of post-hoc analysis point to an interesting influence of analytics skills; firms with analytics skills that are higher than average are able to see a positive association between their analytics capability and firm performance. Organizations should not ignore the critical role of employees and their skills; they should invest in improving the availability of data, their analytics capability, as well as their employees’ analytics skills.

The remainder of this paper is organized as follows: Section 2 describes the theoretical background and key concept of our study; Section 3 presents our research framework and proposed hypotheses. In Section 4, we describe the methodological approach of our study; this is followed by Section 5, which presents our results and findings. Finally, in Section 6, we discuss the implications of our study for research and practice, acknowledge the limitations, and provide suggestions for future research.

2. Theoretical Background and Literature Review

2.1. Organizational Information Processing Theory (OIPT)

As an essential resource, information should be utilized effectively by firms, especially in uncertain environments [17,18]. According to OIPT, in uncertain situations, organizations may follow two strategies: develop mechanistic organizational processes to reduce their needs for information; or enhance their information processing capacity [17,18]. Galbraith [18] suggests that firms may reduce their information processing needs by developing slack resources and/or developing self-contained tasks; however, these actions require great investments, and they do not enhance the firms’ responsiveness [20].

The alternative strategy is to increase the information processing capacity, which can occur by investing in lateral relations and vertical information systems [26]. Lateral relations can include firms’ processes and relationships that are associated with external sources (suppliers and customers) and the internal integration of functions within the firm. For instance, firms that engage in supply chain integration increase their information processing capacity through enhancing their lateral relations [26]. The other way to increase the information processing capacity is by employing vertical information systems,

which refer to mechanisms that enable firms to process information efficiently during task performance [17,26].

2.2. Supply Chain Integration

Supply chain process integration is defined as “the degree to which a focal firm has integrated the flow of information, material, and finances with its supply chain partners” ([27], p. 230). According to the current literature, supply chain process integration consists of three parts: integrating information flow, physical flow, and financial flow [27,28]. Integrating information flow refers to the extent to which a firm shares operational, tactical, and strategic information with its supply chain partners. Specifically, a firm needs to share its supply-and-demand-related information to have a successful integrated information flow [27,29]. Information flow integration allows firms to better understand and anticipate the changes in the customer and supply markets. Physical flow integration is defined as the firm’s level of using global optimization with its supply chain partners to manage and control the flow of materials and goods [27]. Physical flow integration is the building block of efficient inventory management and enables firms to implement some of the well-known yet complex supply chain strategies, such as just-in-time and mass customization [30]. Financial flow integration refers to the exchange of the financial resources with the supply chain partners [27]. Some examples of financial flows are prices, invoices, payments, account payables, and credit terms [27,29].

2.3. Analytics Capability

Analytics capability has been used in current research to refer to the capabilities that allow firms to collect, process, and analyze data in order to drive valuable insights (e.g., [31–34]). According to current reports, many organizations are investing heavily in technology to help them manage and analyze their ever-increasing data [35]. Despite this growing popularity, the academic literature on data analytics capability is still nascent [20,36], and most of the existing studies are conceptual [37]. Moreover, there are some inconsistencies in the findings of the current literature. Most of the existing studies emphasized the use of IT tools as data analytics capability [38]; however, according to the study of Srinivasan and Swink, analytics capability includes both IT tools and firms’ processes. Hence, in this study, we define analytics capability as organizations’ investments in developing the required tools, techniques, and processes to be able to process, organize, and analyze data to gain critical insights [20].

The existing studies have explored the role of analytics capability in enhancing organizations’ performance and have defined different elements that can increase firms’ analytics capability. For instance, a firm’s size has been found to be positively associated with a firm’s analytics capability [39]. Studies suggested that firms’ managerial practices and data capability are essential factors in driving better performance [40]. Specific to the supply chain, studies have shown that analytics capability increases supply chain agility, which leads to a competitive advantage of the firms [41] and enhances the supply chain resilience [42]. Moreover, studies have suggested different supply chain related factors that can lead to analytics capability. For instance, supply chain visibility has been found as a functional resource for developing analytics capability [20]. Another stream of research has studied the relationship between analytics capability and sustainable supply chains; for instance, Cetindamar et al. [43] conducted an exploratory study and suggested that data analytics capability can play a critical role in developing sustainable practices in organizations.

Recent studies [24,44] have argued that the integration of supply chain resources would lead to improved data analytics capability and called for future studies to empirically test this argument. To follow these recent calls, one of the main objectives of our study is to empirically test the effect of supply chain process integration on data analytics capability. Table 1 summarizes the current studies on analytics capability and their findings.

Table 1. Selected studies in the analytics capability literature.

Type of Article	Study	Context/Key Question	Key Findings
Empirical-Survey	[34]	Big Data Analytics (BDA) capability/impact of BDA capability on organizational outcome	BDA capabilities positively influence organizational outcomes
	[20]	Supply chain management/examining association between operational visibility and analytics capability	Supply chain visibility increases analytics capability. Analytics capability improves operational performances, especially for firms that are more flexible
	[38]	Understanding factors influencing firms' intention to use business analytics	Security concerns and risk perceptions are deterrents of analytics use; organizational innovation capabilities are important in leading to analytics use.
	[39]	Exploring the relationships between analytics capabilities and analytics investment decision	Firms that invest in analytics have higher levels of analytics capabilities, are larger, and are in less-competitive industries.
	[40]	Studying the influence of big data decision-making capabilities on decision-making quality among Chinese firms.	Leadership, talent management, technology, and organizational culture significantly influence big data decision-making capability.
	[45]	Civil and military organizations engaged in disaster relief operations/understanding effect of big data analytics capability on trust and collaborative performance.	Big data analytics capability positively impacts swift trust and collaborative performance.
	[46]	Empirically testing the capability framework identified by Cosic et al. [47]	Strong positive correlation exists between enhanced business analytics
Conceptual-Literature Review	[36]	Supply chain management/examining misalignment between the scholarship and practical managers' needs	Organizations need to have a strategic plan to utilize business analytics; this plan involves cultural change.
	[43]	Supply chain management/impact of big data on sustainability	It is expected that big data analytics positively influence the environmental practices of the firms.
	[44]	Supply chain management/understanding big data analytics in big data-driven supply chains and the role of performance measures and metrics	The findings show two possible categories for performance measures and metrics that are applicable to big data-driven supply chains; they propose a framework for big data-driven supply chains performance measurement systems.
	[24]	Supply chain management/studying data-driven sustainable agriculture supply chain	Proposes a framework that can be used in agri-food supply chains; supply chain visibility is found to be among the main driving forces for developing analytics capability.
Conceptual-Case Study	[37]	Proposing a comprehensive theoretical framework for business analytics and its impacts on performance	The findings provide a solution (framework) for firms that are overwhelmed by data and/or are struggling to benefit from data.

3. Research Model and Hypotheses

Relying on OIPT as the theoretical foundation and extending the current literature, we suggest that supply chain process integration would positively influence the analytics capability of a firm. Consistent with the current findings, we propose that analytics capability would enhance a firm's performance. We also argue that the impact of analytics capability on firm performance would be influenced by employees' analytics knowledge. Figure 1 shows our proposed research framework.

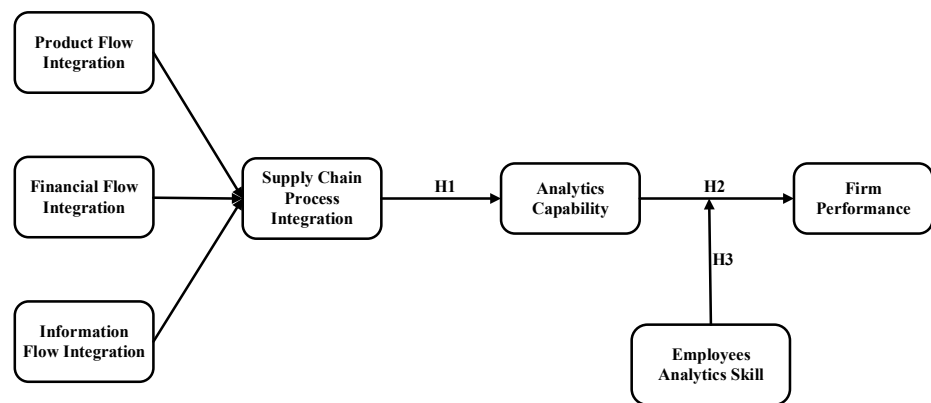


Figure 1. Research Model.

3.1. Supply Chain Process Integration and Analytics Capability

Supply chain managers need to analyze data collected from their supply chain partners to gain insights and make decisions. Integrating supply chain processes enables firms to have a better visibility throughout their supply chain and have access to their supply chain partners' data. Studies have shown that the availability of data is a critical factor in enhancing firms' analytics capability [10]. Hence, firms with integrated supply chain processes are better positioned to also develop the required systems and processes to support analytics capability. In addition, on top of collecting data from their supply chains, firms require proper analytics tools to manage the collected data and make appropriate decisions. Therefore, supply chain process integration would enhance firms' abilities to develop analytics capability. Following this line of reasoning, we suggest that:

Hypothesis 1 (H1). *Supply chain process integration is positively associated with analytics capability in firms.*

3.2. Analytics Capability and Firm Performance

According to the OIPT, greater capacity to process information will enhance an organization's performance [17]. Analytics capability refers to the use of appropriate tools, techniques, and processes to organize, process, and analyze data. Following the OIPT, analytics would be considered as a vertical information system. Therefore, analytics capability enhances firms' information processing capacity. In the supply chain context, analytics capability enables firms to incorporate more relevant, richer, and real time information into their operational decisions. As explained by OIPT, information can replace the firms' inventory and capacity [48]; therefore, firms that are able to process data and gain information would have better insights into demand and supply and consequently develop sound decisions. This would lead to a firm's greater performance. This suggestion is also consistent with the current findings in the literature, which suggest that analytics capability can enhance an organization's performance (e.g., [20,44,46,49–51]). Hence, we hypothesize:

Hypothesis 2 (H2). *Analytics capability is positively associated with firm performance.*

3.3. The Role of Employees' Analytics Skills

The literature on use of IT in businesses has emphasized the skills of IT personnel as a critical resource in utilizing IT and gaining business values (e.g., [52]). The suggestion of developing employees' IT skills and merging them with firms' technology goes back to the sociotechnical framework and literature [53]. The literature has suggested that, in order to maximize the benefits of utilizing technology, businesses should simultaneously nurture and manage their employees' skills and knowledge [49,53–55]. The consideration of employees' skills is particularly relevant in the context of data analytics. Analytics skills refer to the employees' knowledge and experience in using analytics tools to integrate,

analyze, and visualize data [56]. Having employees with the right knowledge and skills is an important resource for businesses to use their analytics capability and generate insights from analytics tools and techniques. Without people with the right analytics skills, the organization cannot utilize their analytics capability.

Existing studies mostly focused on analytics capability in terms of technology and processes (e.g., [20,42,51]); hence, the role of employees’ analytics skills is largely not explored. Moreover, there are inconsistent findings in the academic and practical literature, as organizational reports show that many firms were not able to improve their performance based on their analytics investments. To shed light on this inconsistency, we suggest that, to effectively utilize the analytics capability, firms should also invest in improving their employees’ knowledge and skills. Following this, we propose that:

Hypothesis 3 (H3). *Employees’ analytics skills would positively moderate the relationship between analytics capability and firm performance such that, when employees’ analytics skills are greater, the positive relationship would become more significant.*

4. Methodology

To test our proposed hypotheses, we collected data through an online survey targeting supply chain managers in North America. Supply chain managers were targeted since they are mostly likely to have relevant knowledge of their supply chain networks as well as firms’ analytics solutions. All measurement items in the survey were adapted from well-established scales (see Table 2) and were measured on a seven-point Likert scale. All constructs were operationalized consistent with the literature. Firm performance, analytics capability, and employees’ analytics skills were measured as reflective. Supply chain process integration has been considered as a formative second order construct with formative first order constructs (formative–formative) in the literature [27].

Table 2. Measurement Items.

Construct	Items	Loadings	Developed from
Supply chain process Integration	Product flow integration (Mean: 5.380, SD:1.107):		
	1. Inventory holdings are minimized across the supply chain.	0.717 +	
	2. Supply chain wide inventory is jointly managed with suppliers and logistic partners.	0.857 +	
	3. Suppliers and logistics partners deliver products and materials just in time.	0.851 +	
	Financial flow integration (Mean: 5.405, SD: 1.159):		
	1. Account Receivable processes are automatically triggered when we ship to our customers.	0.812 +	[29]
	2. Account Receivable processes are automatically triggered when we receive supplies from our suppliers.	0.894 +	
	Information flow integration (Mean: 5.401, SD:1.076):		
	1. Production and delivery schedules are shared across the supply chain	0.848 +	
	2. Performance metrics are shared across the supply chain	0.757 +	
3. Supply chain members collaborate in arriving at demand forecasts	0.773 +		
4. Our downstream partners share their actual sales data with us *	0.555 +*		
5. Inventory data are visible at all steps across the supply chain	0.752 +		

Table 2. Cont.

Construct	Items	Loadings	Developed from
Analytics capability <i>Mean:5.433</i> <i>SD:1.044</i>	1. We can use advanced analytical techniques (e.g., simulation, optimization, regression) to improve decision making	0.777	
	2. We can easily combine and integrate information from many data sources for use in our decision making	0.800	
	3. We can use data visualization techniques (e.g., dashboards) to assist users or decision-makers in understanding complex information	0.799	[20]
	4. Our dashboards can give us the ability to decompose information to help root cause analysis and continuous improvement	0.771	
	5. We can deploy dashboard applications/information to our managers' communication devices (e.g., smart phones, computers)	0.772	
Analytics skills <i>Mean:5.801</i> <i>SD:1.078</i>	1. Our data analytics users possess a high degree of data analytics expertise	0.885	
	2. Our data analytics users are knowledgeable when it comes to utilizing such tools	0.921	[56]
	3. Our data analytics users are skilled at using data analytics tools	0.894	
Firm performance <i>Mean:5.336</i> <i>SD:1.106</i>	1. Average return on investment	0.888	
	2. Average profit	0.847	
	3. Average return on sales	0.822	[49,57]
	4. Average market share growth	0.838	
	5. Average sales volume growth	0.823	
	6. Average sales (in dollars) growth	0.840	

* Dropped from main analysis. † Outer model loadings (formative construct).

The online survey was sent to a sample of 400 managers whose roles within their firms were verified. We included several screening questions at the beginning of the survey to select the right participants, such as asking the extent to which participants are familiar with the use of analytics within their firms; those who answered “not familiar” were dropped out of the survey. Some respondents did not complete the survey or terminated it before finishing the survey; hence, they were removed from the dataset. After excluding incomplete and inattentive responses, we obtained 240 valid responses. Table 3 shows the characteristics of the studied firms.

Table 3. Descriptive statistics of the sample firms (N = 240).

	Number	Percentage
Annual sales revenue		
Under USD 10 million	48	20%
USD 10-USD 50 million	78	32.5%
USD 50-USD 100 million	80	33.3%
Over USD 100 million	34	14.2%
Number of employees		
0–100	32	13.3%
100–1000	104	43.3%
1000–5000	78	32.5%
5000+	26	10.8%
Industry		
High tech	192	80%
Low tech	48	20%

5. Data Analysis and Results

5.1. Measurement Model

Prior to testing our hypotheses, the measurement model was assessed by checking the internal consistency, discriminant validity, and convergent validity. All items loaded on their intended constructs (loadings > 0.6) (see loadings in Table 2), Cronbach's alpha, and scale composite reliabilities were greater than 0.7, and the average variance extracted (AVE) for all reflective constructs was higher than 0.5 (see Table 3); hence, convergent validity and internal consistency exist. To test the discriminant validity, the square roots of the AVEs were compared with the correlation estimates. As shown in Table 4, the square roots of the AVEs are greater than the corresponding correlations; thus, discriminant validity was established.

Table 4. Discriminant Validity.

	α	CR	AVE	1.	2.	3.	4.	5.	6.	7.
1. Firm performance	0.919	0.923	0.711	0.843						
2. Analytics capability	0.843	0.844	0.614	0.300	0.784					
3. Employees' analytics skills	0.883	0.893	0.810	0.444	0.526	0.900				
4. Supply chain process integration	-	-	-	0.229	0.700	0.445	-			
5. Product flow integration	-	-	-	0.665	0.690	0.344	-	-		
6. Financial flow integration	-	-	-	0.202	0.637	0.397	-	0.665	-	
7. Information flow	-	-	-	0.234	0.701	0.440	-	0.700	0.660	-

To check the existence of common method bias, we conducted a full collinearity test, as suggested by [58]. All variance inflation factors (VIFs) were lower than the 3.3 threshold. To further examine the existence of common method bias, we checked the Hermon one-factor test. The results showed that the five factors were present, and no factor explained more than 38 percent of the variance. Therefore, we can conclude that common method bias is not likely to exist.

For the formative constructs (first order constructs of supply chain integration), the VIF values were also lower than the threshold value of 3.3, which confirms that multicollinearity is not a problem in our measurement model. To further test the discriminant and convergent validity of the formative constructs, the outer model loadings and outer model weights were assessed [59]. A minimum loading cut-off is to accept and keep the dimensions with loadings equal to or greater than 0.7 [60–62]. All three items of product flow integration and two items of financial flow integration had loadings greater than 0.7. Four items of information flow integration had loadings greater than 0.7; the one item (IF4) with loading lower than 0.7 was removed from further analyses.

5.2. Structural Model

To test the proposed research model, we used SmartPLS 3.0 [63], a comprehensive software package with an intuitive graphical user interface, to run PLS-SEM analyses. Figure 2 shows the results of testing the structural model. The results show that, contrary to our first hypothesis, analytics capability does not impact the firm performance ($\beta = 0.092$, $p > 0.05$); hence, H1 was not supported. However, as hypothesized, supply chain process integration positively influences the analytics capability ($\beta = 0.782$, $p < 0.001$); thus, H2 was supported. As shown in Figure 2, the moderation effect of employees' analytics skills on the relationship between analytics capability and firm performance is positive and significant ($\beta = 0.103$, $p < 0.05$); therefore, our fourth hypothesis (H4) was also supported.

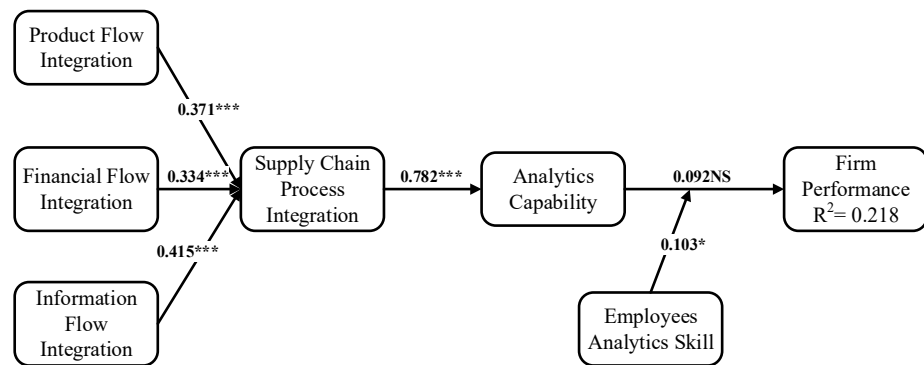


Figure 2. Analysis results of the structural model (* $p < 0.05$, *** $p < 0.001$).

5.3. Post-Hoc Analysis

5.3.1. Control Variable Effects

The impact of control variables, i.e., firm size (number of employee), firm’s sale revenue, and industry type (high tech vs low tech), on firm performance was evaluated. None of the control variables exerted a significant effect on firm performance.

5.3.2. Interaction Effect

As shown in Figure 2, the effect of analytics capability on firm performance is not significant; however, this effect is significantly moderated by employees’ analytics skills. This means that analytics capability cannot improve firm performance by its own, and analytics skills should exist. To obtain a better understanding of the role of employees’ analytics skills, we explored this moderation by using common moderation plotting techniques.

Figure 3 shows the results of the interaction analysis. As employees’ analytics skills change from low to high, the relationship between analytics capability and firm performance (represented by the slope of the line) becomes positive and significant; however, for low values of analytics skills, the relationship becomes negative (beta values are negative) and non-significant. The figure shows that, for employees’ analytics skills values that are greater than the mean, analytics capability becomes a significant factor in affecting firm performance.

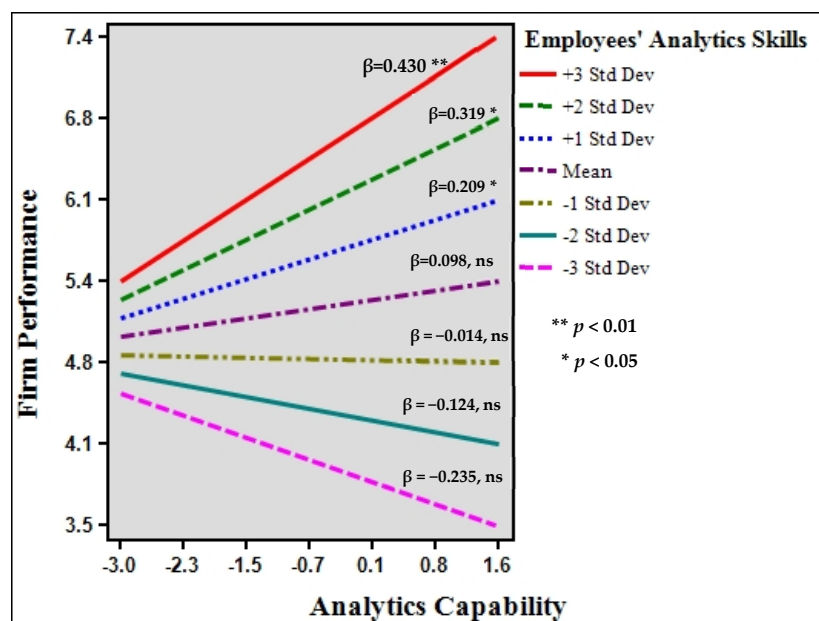


Figure 3. Interaction Plot.

6. Discussion

This research aims to provide an in-depth understanding of how analytics capability impacts firm performance. Existing studies and reports suggested mixed findings about the impacts of data analytics on performance; this study focuses on providing an explanation for the mixed results. Following the organizational information processing theory (OIPT) and drawing from the extant literature, we sought to explore: 1. the relationship between supply chain process integration and data analytics capability and 2. the role of analytics capability and employees' analytics skills in enhancing firm performance. Our first research objective extends the current literature on data analytics by exploring the role of supply chain elements, namely, supply chain process integration, in enhancing the data analytics capability. Consistent with the literature's suggestions (e.g., [10,20]), our results show that, in order to enhance the analytics capability, an important step for firms is to increase data availability. Supply chain process integration enables firms to integrate their supply chain and consequently enhance their data availability.

Our second research goal helps explain those mixed findings in the literature regarding the effect of data analytics on firm performance. Some studies report a positive association between firms' analytics capability and performance (e.g., [20,50,51]). On the other hand, reports and surveys show that some firms were not able to see any enhancements in their performance by increasing their analytics capability (e.g., [4-7]). Our results provide a reason for these mixed findings. As our analyses show, employees' analytics skills impact the effect of analytics capability on firm performance. Some firms only invest in analytics tools and processes and forget the importance of analytics skills. Hence, these firms cannot generate any positive outcome from investing in analytics capability. However, firms who invest in improving their employees' analytics skills, in addition to increasing their analytics capability, see an enhancement in their performance. Figure 3 shows this moderation in detail. For low values of analytics skills (below one standard deviation above the mean), the relationship between analytics capability and firm performance is negative and non-significant. However, for values of analytics skills greater than the mean, the relationship becomes positive and significant.

6.1. Implications for Research and Practice

Our study has several implications for both research and practice. There have been recent calls in the analytics literature to conduct more empirical studies and, more importantly, to explore the role of data availability. Davenport and Harris [10] suggested that the first step in utilizing data analytics capability is improving the data availability. Following their argument, Srinivasan and Swink [20] studied the role of supply and demand visibility on analytics capability. Our study extends these studies and suggests that supply chain process integration is an important consideration in enhancing analytics capability. Current IS literature has mostly focused on information technologies and their transactional capabilities. Extending these findings, our results show that inter-organizational integration is an important element in establishing analytics capability. This finding suggests that organizations should consider the co-development of lateral relations and vertical information systems. In other words, firms should not only enhance their technological capabilities, but they should also focus on improving their internal and external processes.

Our findings suggest that data analytics capability cannot affect the firm performance by itself; it should be integrated with employees' analytics skills. This result can provide a reason for the inconsistent findings in the academic and practical literature, as most studies argue that analytics capability would enhance firm performance, and, conversely, practice surveys and reports show that many companies have failed in generating benefits and enhancing their performance from their investments in analytics. Employees' skills play an important role in making analytics capability beneficial for firms. As our post-hoc analysis shows, when employees' analytics skills are low, the relationship between analytics capability and firm performance is negative and non-significant (see Figure 3), and, as employees' analytics skills increase, the effect of analytics capability on firm performance

becomes positive and significant. This finding may show that, if firms invest in analytics but do not improve the skills of their employees, they may even see negative effects on their performance, as they do not utilize their resources properly. Previous studies mentioned the lack of analytics training as a barrier to business analytics adaptation [25], and our study is among the first that provides empirical evidence for the role of analytics skills.

The results of our study suggest that organizations that are interested in investing in analytics capability should carefully consider these two main factors: 1. their supply chain and the degree of process integration—how fast they can acquire/share information; and 2. their employees' analytics skills—what skills they need to develop and what training should be established. If firms do not evaluate these terms first, investing in and growing analytics capability may not produce improvements in performance.

6.2. Limitations and Future Research

Our study has some limitations which provide opportunities for further research. We explored the role of supply chain process integration in impacting analytics capability; however, other supply chain factors such as firms' supply chain strategies, the complexity of the supply chain, market uncertainty, etc. may also play a role in affecting firms' analytics capability. Future studies should extend our research model and explore other important factors in this domain. Our study tries to fill the existing gap in the literature and provides explanations for the inconsistent findings regarding the role of analytics capability in improving performance. Our results show that employees' analytics skills moderate the relationship between analytics capability and firm performance. Future studies should explore other elements to find other possible explanations for the inconsistency between the academic findings and practical results. For instance, factors such as employees' behaviors, managers' knowledge, manager–employee relationships, and change resistance may also explain the inconsistent findings. Moreover, we call for future research to use other research methodologies to address the limitations associated with cross-sectional survey-based research methods.

7. Conclusions

This research examines the association between supply chain process integration, analytics capability, and firm performance. Drawing from organizational information processing theory, we identified that supply chain process integration positively impacts analytics capability; however, despite our expectation, analytics capability cannot enhance firm performance by itself. The results emphasize the importance of employees' analytics skills. In order to receive benefits from analytics capability, firms should invest in improving their employees' analytics skills. This finding can explain the inconsistency in the literature regarding the role of analytics capability in improving firms' performance. Future research should examine other important factors to better understand the necessary conditions for realizing value through analytics adoptions.

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