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# Realizing value from shadow analytics: A case study

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ABSTRACT

Despite suggestions that analytics projects have value, the literature has, at times, glossed over the obstacles organizations must overcome to realize value from analytics. This research reports on a longitudinal case study of one organization's efforts to improve its profit margins by incorporating analytics into how it generates revenue. The case describes a business unit launching the organization's analytics initiatives, which they deliberately hid from their information technology department to reduce interference. Our study finds that realizing shadow analytics value involves a 3-phase sensemaking process that redefines organizational structures and sets organizations on the path towards digital transformation. These findings offer implications to the mechanisms and structures necessary for realizing value from analytics. Practically, analytics projects may require managers to rethink project management practices and business unit's and IT department's roles in analytics projects.

## Introduction

FOMO – fear of missing out – is a modern slang term describing how people dread missing out on "amazing" experiences happening elsewhere (Dictionary.com, 2019). Although commonly associated with millennials, organizations are not immune to FOMO, especially when it comes to adopting new technological innovations (Wang, 2010). FOMO is evident in the conferences and books addressing how organizations can use digital technologies to remain competitive in today's turbulent business environment (Kane et al., 2019). Most digital technologies fit into the popular SMACIT acronym, which includes social, mobile, analytics, cloud, and the Internet of Things (Vial, 2019). When organizations that were successful in the pre-digital era implement digital technologies to alter how they create value, the process is called *digital transformation* (Sebastian et al., 2017; Vial, 2019).

While SMACIT technologies generally work in combination with one another, organizational projects will often focus on one SMACIT technology such as analytics. Many successful organizations founded in the pre-digital era believe that analytics can put them on a path towards digital transformation (Sebastian et al., 2017; Wang et al., 2019). In 2018, investing in analytics applied to big data was the top priority for United States-based organizations (Kappelman et al., 2019). Furthermore, the International Data Corporation (IDC) predicted that analytics investments would increase by 13% over the next three years (IDC, 2019). In this paper, *analytics* refers to statistical techniques and tools applied to big data and used in combination with SMACIT technologies to create digital transformations (Dong and Yang, 2020; Vial, 2019). *Big data* describes an exponential rise in the volume, variety, velocity, and veracity of

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data (Gerloff and Cleophas, 2017; Günther et al., 2017).

Unfortunately, organizations often find out the hard way that realizing value from analytics is an immensely complicated undertaking. Analytics projects may require pre-digital organizations to depart from existing ways of doing business, dominant logics, and cultures (Günther et al., 2017; Mikalef et al., 2018). Across industries, organizations tend to be overly optimistic about the potential returns of analytics projects while downplaying the "hard work required to execute and sustain a successful analytics strategy" (Ransbotham et al., 2016, p. 4). Analytics projects differ from other technology projects in at least two ways. First, organizations may lack the data necessary to execute analytics projects (Mikalef et al., 2018). Second, whereas in many technology projects, knowledge is transferred from vendors to clients on a one-time basis, analytics is a *generative* technology where knowledge creation and exploitation evolve continuously (Wang et al., 2019).

Given analytics' generative characteristics, business unit (BU[1]) managers with domain expertise, rather than IT managers, need to work closely with analytics vendors. Yet organizations often place analytics and the relationship with analytics vendors under the control of internal IT departments (Haffke et al., 2017; Tallon et al., 2013). In many organizations, this structure prohibits BUs from initiating analytics projects, which is unfortunate because internal information technology departments (hereinafter IT) often lack the innovative capabilities and resources to execute analytics projects (Furstenau et al., 2017; Haffke et al., 2017). This situation suggests that IT governance structures need to evolve (Sharma et al., 2014). Yet, we know little about how organizations create flexible structures that facilitate the cross-disciplinary interactions necessary to effectively carry out analytics (Günther et al., 2017).

In summary, what remains elusive is understanding the pathway towards analytics value realization, especially when BU managers outside of the IT department lead the effort. Investigating the process of realizing value from analytics requires understanding the context and informal aspects of strategy making, which mainstream information systems research has mostly not addressed (Chanias et al., 2019). Motivated by these gaps in research, we conducted an interpretive in-depth case study of a supply chain company (SupplyCo[2]) that engaged an analytics vendor (GenData) to develop revenue-generating analytics projects. We studied the effort from conceptualization to realizing value from an analytics project.

Our study resulted in a theoretical model that answers the following research question: *How do BU managers, outside the purview of IT, realize value from analytics?* We developed the model by iterating *from* the empirical data *to* the literature on sensemaking, analytics value realization, and shadow systems. The model offers practical implications about the path towards analytics value realization. In analytics' projects, managers should rethink traditional notions of IT governance, including IT project management, the role of BUs in IT initiatives, and return on investment for analytics' projects.

## Background literature

### *Realizing value from analytics*

While analytics' usefulness is known, the path towards realizing value from analytics is unclear (Grover et al., 2018). We define analytics value realization as a process of creating an analytics project and capturing value from this project by increasing profitability (Gregor et al., 2006; Grover et al., 2018). This definition focuses on the functional value, which may come from business process improvement, organizational performance, product & service innovation, or customer experience & market enhancement (Grover et al., 2018).

While the specific mechanisms through which organizations realize value with analytics projects are still underexplored (Dremel et al., 2020; Günther et al., 2017; Mikalef et al., 2018), the analytics value creation framework proposes several mechanisms that may lead to analytics value realization (Grover et al., 2018). These mechanisms include transparency & access, discovery & experimentation, prediction & optimization, customization & targeting, learning & crowdsourcing, and continuous monitoring & proactive adaptation (Grover et al., 2018).

The analytics value creation framework discusses these mechanisms mostly at the data level (Grover et al., 2018). Yet realizing value from analytics requires more than the data set, the techniques to collect and manage big data, and implementation experience with analytical methods and tools (Grover et al., 2018; Mikalef et al., 2018). Therefore, this research aims to extend the analytics value creation framework from the data level to the organizational and interorganizational levels by focusing on the mechanisms and structures supporting analytics value realization (Grover et al., 2018; Wang et al., 2019). Mechanisms arise from the relationships between structures and actors and explain how and why things happen (Leidner et al., 2018).

While organizations may obtain analytics tools from vendors, internal resources (big data assets, human talent, and expertise) are indispensable to realizing strategic value from analytics (Grover et al., 2018). In particular, an organization's IT maturity and IT leadership influence the development and implementation of analytics capabilities. The absence of IT leadership, technical skills, and the right mindset complicate the IT department's ability to lead analytics projects (Haffke et al., 2017; Svahn et al., 2017). While management has traditionally tasked IT with ensuring efficiency, reliability, scalability, and security of service delivery (Haffke et al., 2017), analytics requires that the IT department expand its focus from stability to agility, innovation, and profitability (Chanias et al., 2019).

When IT cannot expand its focus, BUs like Marketing or Sales may bypass IT and work with analytics vendors (Fogarty and Bell, 2014). Such inter-organizational collaborations between clients and vendors allow organizations to pool their resources (Mitchell

[1] For the purpose of simplification, BU refers to all types of business entities (individual users, business workgroups, departments, or divisions).
[2] Names of all companies and their offerings are pseudonyms

et al., 2002) and benefit both clients in building analytics capabilities and vendors trying to build domain expertise. This decision to outsource analytics to a vendor can create conflicts with both the vendor and the IT department. Despite their potential for creating value, interorganizational collaborations can be problematic: more than 50% of such collaborations fail due to either misaligned goals between the collaborators or opportunistic behavior (Gulati et al., 2012). By hiring an analytics vendor, BUs threaten the IT department's role in providing technology to the business and overseeing technology decisions (Guillemette and Paré, 2012). IT often responds to this threat by controlling and eliminating BU-led technology initiatives under the moniker of "shadow systems" (Furstenau et al., 2017; Kopper et al., 2018). In the analytics context, we describe this trend to outsource instead of turning to the internal IT department as *shadow analytics.* Recent research recognizes that attempts to prohibit shadow systems and shadow analytics may be difficult (Klotz et al., 2019).

*Organizational sensemaking*

Since a BU bypassing its internal IT department to work with an analytics vendor may create an additional layer of complexity in analytics projects, we identified sensemaking (Weick, 1995; Weick et al., 2005) as the appropriate theoretical lens to interpret our case. Sensemaking is about the interplay of action and interaction, moving towards general long-term goals (Weick et al., 2005). Through sensemaking, groups achieve shared understanding "in situations where complexity and uncertainty are high, ambiguity is great, and the focus problem and external environment are in constant flux" (Rutledge, 2009, p. 20). From a high-level perspective, sensemaking theory describes the process by which organizational actors try and understand events that are "ambiguous, confusing, and violate expectations" (Maitlis and Christianson, 2014, p. 57).

Sensemaking is triggered when organizational actors observe changes in the business environment that disturb existing experience (Weick et al., 2005). For example, analytics may provide both game-changing opportunities for and existential threats to organizations (Sebastian et al., 2017). As managers respond to these opportunities and threats, their sensemaking process unfolds in "cycles of action and cognition" that are ongoing, retrospective, and prospective (Hoyte et al., 2019, p. 272), resulting in new meanings and mental models of the disruptive change (Weick, 1995).

In evaluating possibilities, managers engage in information search activities to seek cues from the environment and develop a more accurate meaning of what analytics means for their business. Information search activities could involve consultations with internal BUs, including IT and external analytics vendors. At the beginning of this sensemaking process, organizational knowledge of environmental change and opportunities are unevenly distributed (Henfridsson and Yoo, 2013). As a result, social interactions may create multiple interpretations of and conflicting responses to the environmental changes (Hoyte et al., 2019) brought about by analytics.

A manager's *identity* impacts his/her interpretations and actions, which then impacts other stakeholders' perceptions (Weick et al., 2005). The resulting cycle either stabilizes or destabilizes the said manager's identity (Weick et al., 2005). Conflicting responses to environmental changes can destabilize identity "by allowing managers to question taken-for-granted assumptions and break away from the status quo" (Hoyte et al., 2019, p. 271). For example, BU managers questioning the taken-for-granted assumption that the IT department should govern technology initiatives could destabilize the internal IT department's identity (Furstenau et al., 2017).

Influential stakeholders can influence other stakeholders' sensemaking and meaning construction with sensegiving and sensehiding techniques (Monin et al., 2013). *Sensegiving* involves attempting to influence the sensemaking and meaning construction of others toward a preferred redefinition of organizational reality (Gioia et al., 2013) that moves stakeholders toward long-term goals (Weick et al., 2005). *Sensehiding* involves "silencing alternative senses … or marginalization of particular voices" as a strategy to buy time and respond to ecological change and ambiguity (Monin et al., 2013, p. 277).

The analytics trade press articles demonstrate the interplay of sensegiving and sensehiding to shape stakeholders' perception of reality. The trade press gives a sense of analytics potential to transform business (Russom, 2011; Watson, 2014). By failing to communicate the struggles associated with realizing value from analytics (Günther et al., 2017), the articles hide sense (Vaara and Monin, 2010). This interplay of sensegiving and sensehiding may partially explain why BU managers, motivated by analytics' success stories, sometimes bypass their IT departments to implement their own analytics systems. BUs hide sense from their IT department to focus on realizing value-form analytics and avoid the IT department's project approval processes and guidance on governance and risk (Furstenau et al., 2017). Our research demonstrates sensehiding in covert shadow systems, which has not been systematically studied (Haag and Eckhardt, 2017; Monin et al., 2013),

As multiple organizational actors move between phases of sensegiving and sensehiding, collective sensemaking may occur (Heaphy, 2016). Collective sensemaking enables coordinated action (Weick, 1995). Members of the collective do not have to share the same meaning; instead, the collective's understanding of the focal problem will develop because of new perspectives, information, or changing events (Rutledge, 2009; Weick et al., 2005). The progression of collective sensemaking implies that an organization's understanding of analytics may evolve through co-evolutionary adaptation, a "virtuous feedback phase, in which organizations build and realize future analytics capabilities through experience, success, and failures" (Grover et al., 2018, p. 404). For example, both Audi (Dremel et al., 2017) and BBVA (Alfaro et al., 2019) progressed through multiple maturing stages in their processes, structures, and competencies with analytics.

In summary, sensemaking and the related concepts of sensehiding, sensegiving, and collective sensemaking can help interpret our case on shadow analytics for several reasons. Sensemaking describes the process by which managers' analytics understanding evolves as they learn more. Sensehiding and sensegiving describe processes that enable managers to realize value from analytics. Sensehiding explains how managers reduce IT department interference to focus on realizing value with analytics. Sensegiving describes interactions with analytics vendors and other BUs to reshape managers' understanding of how analytics can help the organization. Collective sensemaking describes a final process where stakeholders work together towards realizing value from analytics

**Table 1**
Data Collection Timeline.

| Shadow Analytics Project Phase | Dates and Key Activities | Data Collection in Addition to Interviews |
|---|---|---|
| Sensemaking to Respond to Ecological Change | | |
| Part 1: Initial Sensemaking and Sensehiding | May-August 2015: Pre-work to launch the analytics projects | Weekly Status Reports of SpecOps analysts working on the project: (12 weeks * 2 people)<br>4 Focus Groups (60–120 min) with SpecOps Analytics Implementation team |
| Part 2: Gradual Sensemaking | October 2015-April 2016: Evaluating vendors to launch the predictive analytics project | Observed 4 (90-minutes) meetings between SpecOps and analytics vendors (GenData, SysData & VisData) and collected vendor sales presentations |
| Sensegiving to Get Others On-board | February 2017- June 2017: GenData's efforts to relaunch SupplyCo's analytics initiative | Observing 2 (90 min) and 1 5-hour meeting between GenData and SupplyCo. Collected vendor sales presentations. |
| Collective Sensemaking and Experimentation | July 2017-February 2020: Experimenting with project ideas and updates on project impact | 1 Focus Group (90 min) with all SpecOps analysts<br>Observed 3 90-minute meetings between GenData and SupplyCo. |

## Research method

Because studies on analytics value realization —much less shadow analytics value—are scarce to date (Günther et al., 2017; Haag and Eckhardt, 2017), we share a revelatory case (Yin, 2018). *Revelatory cases* give researchers "an opportunity to observe and analyze a phenomenon previously inaccessible to social science inquiry" (Yin, 2018, p. 50). Using an interpretive research approach (Walsham, 2006), we studied the nuances and informal aspects of how the analytics project progressed from inception in 2015 to value realization in 2020. Covert ("shadow") systems and the process of sensehiding described in this study are by nature challenging to study because they are hidden (Haag and Eckhardt, 2017; Monin et al., 2013).

This research focuses on SupplyCo's efforts to initiate a digital transformation strategy with the help of an analytics vendor, GenData. Both organizations are exemplary *pre-digital organizations* - they were historically financially successful in traditional industries, and the digital economy posed a threat to their success (Sebastian et al., 2017). When this study began, SupplyCo's annual revenues were approaching $50 billion, making it a leader in the United States grocery distribution industry. It is one of the only organizations in this industry with a Special Operations BU (SpecOps) focused on enhancing profitability with special projects. In 2015, SpecOps, a BU outside of IT, began investigating how analytics could improve SupplyCo's profit margins. SpecOps' management initially believed they were implementing predictive analytics, which was our study's original focus. As SpecOps struggled to make sense of the project's challenges, sensemaking with analytics became our research topic. Given managers' propensity to share successes with researchers rather than struggles (Browne and Ramesh, 2002), studying the success when the struggles unfolded contributed to this revelatory case (Yin, 2018). Appendix 1, "Study Assessment," explains how this research follows the guidelines for conducting interpretive field research in information systems (Klein and Myers, 1999; Walsham, 1995).

### *Data collection*

Data collection spanned May 2015 until February 2020. Table 1 shows our data collection timeline and the type of data we collected in addition to interviews. Table 2 describes the project's key stakeholders. Appendix 2 shows the stakeholder interviews and Appendix 3 shares our interview guide's foundation. As the project progressed and each stakeholders' understanding of analytics advanced, our interviews changed (Gioia et al., 2013). We stopped collecting data when incremental learning from additional data was minimal (Eisenhardt, 1989).

### *Data analysis*

Recognizing the nascent stage of knowledge on analytics value realization, we adopted a predominately inductive, interpretive approach (Walsham, 2006). We did not impose a priori theory on our data or test a theoretical framework (Gioia et al., 2013; Walsham, 2006). Instead, we collected and analyzed data iteratively, shifting between empirical data and theoretical concepts. Initial analysis began after each interview or meeting, where we wrote memos reflecting on what we'd learned (Walsham, 2006).

Our data analysis consisted of open coding, selective coding, and theoretical coding (Urquhart, 2013). See Appendix 4 "Coding Analysis Examples." To conduct open coding, we read our data and assigned a code to each text line using constant comparison analysis (Charmaz, 2000). Using the qualitative data analysis tool QSR NVIVO, we organized our data and visualized the 174 open codes that emerged. We then grouped our open codes into higher-level selective codes: "Project Description," "Challenges Encountered," "Stakeholder Relationships," "New Insights," and "Project Uncertainty." We used these codes to write narratives describing the project's key phases: "defining the project," "refining the project," "redefining the project," and "experimenting to find a project." The next step was theoretical coding, which considers the relationship between the main categories (Urquhart, 2013, p. 10). We transitioned our language from the data-driven phase descriptions to sensemaking phases since sensemaking was the central category linking our codes

**Table 2**
SupplyCo's Shadow Analytics Project Stakeholders.

| Stakeholder | Description/Roles | Expertise | Culture |
|---|---|---|---|
| Special Operations (SpecOps) | An exploratory innovation BU that develops strategic opportunities and responds to external threats. Works outside formal budgeting controls. No formal IT responsibilities or background. | Generating arbitrage profits, innovation, financial, legal, and governmental | Risk takers and innovators that focus outside the organization to explore new ideas. Driven by financial results. |
| Information Technology (IT) | Oversees SupplyCo's technology. Focuses on keeping the systems running, security, and control rather than on innovation due to budgetary constraints. | Enterprise applications & infrastructure; data management; information security & recovery; infrastructure management | Risk-averse and controlling. Driven by cost and budget constraints. |
| Merchandising | Responsible for maintaining optimal inventory levels for 86,000 items with an average daily value of $1 billion. Spends time "fighting fires," such as resolving delivery and supply problems. | Inventory & supply chain management; commodities forecasting | Risk-averse employees who worked their way up in the ranks by learning on the job. Close-knit, with low turnover. Driven by operational excellence, cost control, key performance indicators, and exploiting existing processes. |
| Analytics Service Vendors:<br>• GenData<br>• SysData<br>• VisData | Consulting firms offering a range of analytics technologies and services to organizations seeking external analytics assistance | Data analysis & modeling; data gathering, integration & storage; full-service cloud-based analytics offerings | Cultures ranged from technically oriented (SysData) to client-oriented (VisData). GenData was in the middle. |

together. Similar to other IS studies (Holeman and Barrett, 2017; Sarker and Sarker, 2009), theoretical coding was more creative than procedural, involving considerable discussion, reflection, and iteration between the data and the literature.

Additional study of sensemaking theory (Weick et al., 2005) led to critical concepts like *sensehiding* and *sensegiving*, which furthered our data interpretation. The case that follows elaborates on the phases of sensemaking that emerged in SupplyCo's experience. As is customary in interpretive studies (Sarker and Sarker, 2009; Walsham, 2006), we provide sample quotes to illustrate the issues project stakeholders faced on the path towards realizing value with shadow analytics. The discussion shares the empirical patterns that emerged. The implications section scales up our findings by sharing how this case extends the existing literature on digital transformation and the mechanisms and organizational structures required for analytics value realization.

## Case Study: Shadow analytics at SupplyCo

This case details how SpecOps, a BU at SupplyCo, created and realized value from a shadow analytics project they initially hid from their internal IT department. As the effort unfolded, SpecOps first realized analytics was not as clear-cut as initially thought, then eventually evolved their analytics value realization effort through the three phases of sensemaking. Just as SpecOps' original analytics project (a predictive price increase model) morphed into other projects and ultimately evolved into a collaborative undertaking that no one envisioned at the outset, this shadow analytics effort had long-term consequences for IT's role at SupplyCo.

SpecOps' Executive in Charge (EIC), also SupplyCo's Chief Financial Officer, founded SpecOps in the early 2000s to identify undiscovered revenue opportunities. Given SpecOps' successful track record of bringing in revenue, it has high status at SupplyCo. For example, SpecOps generated millions of dollars by taking advantage of the tax change associated with U.S. President Obama's health care reform. SpecOps uses part of the money it generates to explore innovative ideas without seeking funding as part of the corporate budgeting process. The shadow analytics initiative in this research was SpecOps' first endeavor into digital technologies. Historically, SpecOps relied on SupplyCo's IT department to provide its systems.

SpecOps' organizational experience contrasts sharply with SupplyCo's other BUs, especially its IT department. Given that SupplyCo makes pennies on the dollar, its other BUs work under extreme cost controls and pursue efficiency objectives. For instance, IT is a cost center primarily responsible for maintaining the ordering, billing, and delivery system to distribute orders to over 55,000 customer locations. Periodic reductions of IT's budgets result in SupplyCo's IT department supporting some systems well beyond their useful life, not hiring staff, and providing BUs with minimal support. As an example, IT has been rolling out a commercial enterprise resource planning system for over a decade. A SpecOps manager explains the relationship between IT and the BUs IT supports, "IT looks for reasons not to do things."

Needless to say, when SpecOps decided to improve SupplyCo's ability to make arbitrage profits by launching shadow analytics, SpecOps did not seek consultation, approval, or oversight from IT. Instead, SpecOps hired a team of five (5) analysts—most with IT backgrounds—and embarked on the effort. Despite SpecOps' can-do attitude implementing shadow analytics was not as clear-cut as SpecOps' management believed, leading us to apply the three-phased lens of sensemaking to interpret SupplyCo's path to analytics value realization.

*Phase 1: Sensemaking to respond to ecological change*

In 2015, SpecOps launched shadow analytics to address the ecological changes in SupplyCo's competitive environment, including the burgeoning analytics phenomenon and SupplyCo's eroding profit margins. Sensemaking to respond to ecological change consists of two sub-phases: 1) initial sensemaking & sensehiding, followed by 2) gradual sensemaking.

*Initial sensemaking and sensehiding*

Initial sensemaking and sensehiding began when SpecOps' EIC conceived this project in 2015 and gained traction when analytics vendors expanded their seminar invitations beyond IT leadership to include other executives. SpecOps' EIC accepted the invitations that SupplyCo's Chief Information Officer (CIO) declined. As a result, SpecOps' EIC perceived that analytics was disrupting SupplyCo's business environment. The EIC initially envisioned using analytics to predict price increases for the 86,000 products SupplyCo sold. As part of normal operations, SupplyCo takes advantage of price differentials between the two markets in which it operates: manufacturer and retailer. SupplyCo purchases manufacturer products, which it distributes to grocery and convenience stores in the downstream retailer market. Specifically, SupplyCo's goal is to increase its profit margins by purchasing excess inventory at lower prices before expected vendor price increases and then selling the product at a higher price. In the quote below, SpecOps' analytics project manager explained why, historically, SupplyCo only applied the arbitrage practices to a few products:

> *For tobacco and candy, the potential price increase is so high; we'll spend as many man-hours as it takes to predict when we should buy-in. For the other 86,000 items that we carry, the juice isn't worth the squeeze.*

So, the analytics project initially focused on applying predictive analytics techniques (regression, multivariate, and cohort analysis) to automate the decades-old manual process of predicting the timing of product price changes. This demanding process relied on Merchandising making judgments based on environmental monitoring, historical trends, and experience. This process involved both Merchandising and SpecOps employees interacting daily with vendor sales representatives, attending industry events, and monitoring legislation. Both groups kept Excel spreadsheets that predicted the timing of vendor price increases. If the envisioned predictive analytics project was successful, SupplyCo could extend its arbitrage inventory holding profits from candy and tobacco to the rest of its product categories.

SpecOps initially attempted to tackle the analytics project using its usual project methodology. Given the profit focus, SpecOps first conducted a feasibility study to determine if the analytics project made financial sense. The feasibility study indicated that had SupplyCo implemented analytics to predict the timing of price increases during this analysis period, the profit gained would have far outweighed the costs of deploying an analytics project. Based on this feasibility study, SpecOps EIC justified bypassing SupplyCo's internal IT department and implementing shadow analytics:

> *IT can't move forward with projects like this because they don't know how to monetize them. For them—everything is a cost. To justify projects, they scream the sky is falling as they did with Y2K [the year 2000 problem], we don't buy that anymore. We can make projects pay—monetize them.*

In conducting this feasibility study, SpecOps' analysts interacted with the two BUs that the analytics project would ultimately impact the most: IT and Merchandising. SpecOps' project manager explains, however, that even though SpecOps needed resources from IT, SpecOps was intentionally "trying to keep IT in the dark." SpecOps feared IT would consider the analytics project their domain and put it through IT's typical vetting, approving, and budgeting processes. The project manager explained that SpecOps' history with IT made SpecOps feel that IT would "look for reasons *not* to do projects and would be an impediment." Despite these efforts to hide the project, SpecOps' analysts still had to interact with IT. A SpecOps analyst explained that he was met with skepticism and suspicion when he requested resources from IT:

> *IT was like, "what are you doing?" We had trouble getting access to the programs and data we needed. When we ran our Excel programs, the only tool they'd give us, it tied the PCs up all night and part of the day. IT wouldn't let us use our tools. They wouldn't let us send attachments to vendors.*

While SpecOps hid the project from IT, they still needed Merchandising's support. Yet, SpecOps lacked systems analysis expertise. Consequently, even though SpecOps conducted only a limited analysis with Merchandising, the analysis revealed that qualitative data (news reports and annual reports) and tacit knowledge (interactions with the vendor sales representatives and government agencies) were necessary to develop a price prediction model. Further, a SpecOps analyst explained that the analysis raised concerns about algorithms eliminating buyers' jobs:

> *Some buyers may have been concerned that this tool [analytics] would replace them, so there was a little bit of that. We had to explain that this is something you would use, not a replacement.*

To mitigate this perceived impact, Merchandising employees limited their participation in the project.

At this juncture, as with most technology projects, SpecOps considered the make (internal development through IT) vs. buy (outsourcing) decision and quickly realized that outsourcing the predictive price model project to an analytics partner was the first step. Although IT had talented resources, the department's narrow focus on maintaining core business systems, infrastructure, security, and support services for mainstream business activities precluded its ability to pursue new, innovative, value-adding projects such as the analytics project. Moreover, based on SpecOps' historical relationship with IT and its repeated struggles to have technical requests fulfilled, SpecOps believed IT lacked the appropriate resources and skillsets for the analytics project. For example, during the feasibility study, SpecOps discovered that IT purged all data greater than five years old to save costs. Even when SpecOps' EIC explained the potential value of analytics to the business, IT would not stop purging data. Even though they may ultimately need IT to integrate and

maintain the analytics system, SpecOps focused on selecting an analytics vendor for the predictive analytics project.

*Gradual sensemaking*

SpecOps' understanding and assumptions regarding the analytics project evolved as they interacted with five potential analytics vendors and gradually made sense of the project. These interactions revealed a diversity of vendor styles, proposed solutions, and client expectations that gave way to a whole new set of challenges, questions, and uncertainties regarding the project. Nowhere was this diversity more apparent than the initial response from the vendors that fit into one of three categories: 1) your project is impossible, 2) we have a tool [out-of-the-box] that can solve that problem, or 3) we can build a custom model. From these initial responses, SpecOps narrowed the field down to three finalists: GenData, SysData, and VisData. Of the three, GenData and SysData claimed that they could build a customized algorithm to recommend optimal inventory levels that Merchandising could use to make weekly inventory purchase decisions. SpecOps was familiar with GenData because GenData provided SupplyCo's technical infrastructure.

For the second round of competition, SpecOps gave each vendor a set of 40 products (beef jerky, water, peanut butter cups) to develop a price prediction model. SpecOps intended to evaluate each vendor's predictive model's results against known historical price increases for each product. Table 3 shows the results, insights, and challenges this exercise created. Based on this evaluation process, SpecOps questioned if analytics could predict opportunities to generate an inventory holding gain incorporating a broad spectrum of factors (weather, political environments, commodity prices, and analysts' reports).

In addition to questions regarding project feasibility, questions about the philosophical approach, data gathering, and vendor communication emerged. SpecOps wanted an application that automated Merchandising's buying process with a weekly optimal inventory number generated from the predictive model. However, Merchandising's Vice President opposed *automated* decision-making; instead, the Vice President believed the application should support buyers' and commodity analysts' *human decision making*. In making this argument, he stated:

> *From my standpoint, it [the predictive analytics application] would be a simple report. Maybe the data behind [it] shows the market trends on the commodities that could be driving that [trend] so that we could do our analytics and compare it to our homegrown spreadsheets that say, "Yeah, it seems like it's following that market."*

Such differences over the philosophical application of analytics as a decision-making tool (whether it was a decision aid or a buyer replacement) and concerns among Merchandising personnel over job performance created project resistance. SpecOps needed to consider how to eventually obtain buy-in from the buyers who would use the application. While Merchandising made money from "buying in" on products, their incentive system required them to keep inventory as low as possible—a goal opposed to the project's goal. To gain Merchandising's support, SpecOps' EIC began inviting Merchandising's Vice President to vendor meetings. At a meeting with SysData, Merchandising's Vice President expressed his concerns: "I am not sinking $100,000 into inventory unless you can tell me there is a high probability it will work." SysData's data scientists teleconferencing in from abroad responded to this concern by discussing confidence intervals and recommending a statistics textbook. Concerned over SysData's inability to address the question in business terms, SpecOps EIC shut down the meeting and noted: "We've broached the biggest hurdle, which I think is getting Merchandising to see the benefit of the analytics project."

Furthermore, SpecOps had not previously considered analytics vendors' expectations for clients like SupplyCo to provide the data that would feed the predictive model. For example, SysData clearly outlined client responsibilities, which included SupplyCo providing price data for each product, commodity prices, ingredient data, supplier financial metrics, and competitor information. SupplyCo wondered what it was paying SysData for since SupplyCo would have to gather and enter the data manually. In fact, some data sources

**Table 3**
Analytics Model Test of 40 Product Items.

| Analytics Vendor | Test Results | New Insights/Challenges Raised |
|---|---|---|
| GenData | GenData claimed they could solve the problem with a customized solution that moved beyond regression techniques. GenData was unwilling to share the results of their methodology until SupplyCo signed a non-disclosure agreement. | Statistical methods to solve problems were complex, and models needed qualitative data. Interactions raised intellectual property rights issues between clients and analytics vendors. |
| SysData | SysData could not solve the problem with regression, so it solved the problem by looking at price changes for similar groups of products (cohorts) to increase the sample size. However, they would not share results without SpecOps paying for further proof of concept. | Raised question of who should pay for the proof of concept |
| VisData | Like SysData, VisData determined that multivariate regression would not work with this problem due to a lack of data points. Since their out-of-the-box solution could not provide a customized solution, SpecOps' stopped considering VisData. | Out of the box (packaged), solutions would not work for the problem posed by SpecOps |

such as social media, press releases, or weather reports would require considerable work for SupplyCo to transform the data into a usable format for the vendor and much of the data SysData requested was not easily accessible. Gathering all of this data seemed daunting to SpecOps. SysData's data requirements stood in stark contrast to GenData, who had only requested subject matter experts from SupplyCo.

Finally, SpecOps had to adapt to different vendor communication styles throughout the evaluation process. For example, SysData brought their international experts via a poorly connected teleconference and communicated in highly technical terms, which hurt their chances of landing the contract. SysData's penchant for technical communications and their inability to answer questions in simple terms caused SpecOps to consider communication an essential criterion in vendor selection. After an ongoing conversation about type 1 and type 2 statistical errors and the promise of an end product report that showed confidence intervals, the EIC of SpecOps explained why he stopped considering SysData as an analytics vendor:

> *We weren't getting anywhere with the questions. The data scientists offered us a textbook on confidence intervals! Not even their relationship manager understood confidence intervals. We're not sinking money into inventory based on confidence intervals. If we can't understand them now, we won't be able to understand their reports. This is going to be a hard-enough sell internally.*

In contrast, GenData took technical concepts and communicated them in business terms to the audience. Further, GenData was the only one of three prospective vendors that visited SupplyCo's corporate campus with a full team of experts. Along with GenData's existing relationship as SupplyCo's infrastructure provider, these factors led to SpecOps selecting them as the project's analytics vendor. As SpecOps' evaluated GenData's contract, they better understood the price prediction project's challenges. These challenges included: new insights revealing the technical challenges of building a price prediction algorithm and the organizational issues. SpecOps' Vice President hinted at the difficulties and frustrations that accompanied this project:

> *How do you feed information into the model that we're going to have a strong hurricane season, that water prices will rise because the water plant got washed away? That's the challenge of this thing. We know we can't be perfect. We don't know if it's going to work. We know that it will work to some extent because we've already found one thing and made an impact.*

Even if the algorithm worked, organizational issues surfaced when SpecOps faced the daunting task of providing a point of contact to provide GenData the necessary data. Providing such a contact would require ongoing communication and cooperation with IT and Merchandising. Would Merchandising help develop a system that buyers perceived might eventually displace them, lead to wrong decisions, or marginalize their value-add? Furthermore, SpecOps had already outsourced the project, in part, to avoid dealing with IT. Struggling with these issues, SpecOps put the project on hold to make sense of organizational issues and encounters with analytics vendors.

*Phase 2: Sensegiving to get others on-board*

During the eight months that passed while SpecOps' analytics project was on hold, GenData pivoted its analytics strategy to incorporate approaches that helped clients with organizational-wide collaboration. To communicate the revised strategy, GenData's relationship manager met with SpecOps' EIC. He brought a newly hired 30-year grocery industry veteran whose expertise was part of the strategy shift to make analytics more relevant to clients by speaking their language. At the meeting's conclusion, GenData offered to host a series of innovation forums with SupplyCo's executive team to discuss how GenData's new analytics capabilities could help SupplyCo's business.

GenData's enhanced capabilities included pioneering innovation labs and acquiring CityBeat, a popular location-based app. These capabilities created portability and interconnectivity with big data to help organizations realize the value (Günther et al., 2017). Innovation labs are located near client offices and ran by design thinking experts who pull on GenData's capabilities to create analytics solutions with clients collaboratively. One of these capabilities is using CityBeat, which provides information on people's movements, demographics, area events, social media, and local news. SpecOps recognized that GenData's enhanced capabilities addressed some of the challenges that halted the SpecOps' price prediction project.

After communicating these capabilities, GenData encouraged SpecOps to invite SupplyCo's BUs to develop a series of potential analytics use cases to present to a team of GenData experts. SpecOps invited SupplyCo's IT managers because SpecOps' learned that hiding analytics projects from IT *("sensehiding")* was ineffective. Merchandising changed their attitude about analytics and participated because they were facing mounting pressure to improve profit margins. SpecOps, IT, and Merchandising BUs presented six use cases to a cross-disciplinary GenData team. A few weeks later, the group reconvened and identified several analytics projects with revenue generation potential.

This process gave SupplyCo's other BUs sense *("sensegiving")* about analytics and reduced many of the uncertainties surrounding analytics at SupplyCo. Yet, two uncertainties remained: IT pushback and budget. SupplyCo's CIO pushed back on SpecOps working with GenData– IT's vendor– to champion analytics at SupplyCo. The CIO complained about IT governance to the Chief Operating Officer, forced GenData to conduct pre-meetings with IT before the organization-wide analytics meetings, and handpicked a few projects that emerged from the innovation forums for IT to own. The budget was a second uncertainty. No BU, other than SpecOps, had the budget or resources to experiment with analytics in GenData's innovation labs.

*Phase 3: Collective sensemaking and experimentation*

To implement some of the analytics projects identified in the GenData meetings, GenData engaged with SpecOps in the innovation lab. The innovation lab's premise is that clients and vendors cannot define and implement analytics projects as they had historically done for other technology projects. Instead of the client specifying the vendor's requirements, analytics projects require clients and vendors to collaborate and assess an idea's viability. GenData pioneered this concept after failing to close several analytics contracts – similar to what happened when SpecOps did not move forward with the predictive analytics project.

In the innovation lab, projects progress through three stages: proof of concept, pilot, and implementation. In the proof-of-concept stage, clients and vendors co-create projects using an agile, design thinking approach to see if a client's idea for using analytics is feasible. After 2–3 weeks in the proof-of-concept stage, the client and vendor decide whether to move the project to the pilot stage. After considerable negotiation over the intellectual property rights of ideas co-created in the innovation lab, SpecOps signed a contract to run at least three projects through the innovation lab: Competitive Intelligence, Trailer Advertising, and Driver Retention.

- The Competitive Intelligence project envisioned gathering information about competitors to give SupplyCo an advantage when competing for business. For example, knowing if competitors owned their trucks, had refrigerated trucks, or maintained their trucks.
- The Trailer Advertising project envisioned using the 5,000 trailers SupplyCo uses to make deliveries as a mobile billboard by selling advertising space and providing analytics showing the demographics of people who view the trailer.
- The Driver Retention project envisioned creating a more appealing workplace for SupplyCo's truck drivers by using analytics to track and address turnover trends.

The innovation lab energized SupplyCo's managers, who wanted to be a part of a potential digital transformation. Senior leadership from Marketing, IT, and Human Resources participated in lab meetings by sharing expertise and providing feedback. SpecOps realized that analytics' uncertain nature requires constant attention to innovation and access to partners, including IT, that can bring various resources to bear on a project. IT recognized that overt analytics projects have value and shifted its role somewhat from policing to consulting.

Despite creating energy, the lab generated some challenges, including intellectual property rights, client attention, and competing definitions of value. SpecOps forced GenData into an intellectual property agreement that prevented GenData from sharing a project with other clients. Further, SpecOps did not have the attention, time, or budget to continuously and simultaneously run multiple projects through the innovation lab. As a result, running the initial three projects through the innovation lab took over a year. The third issue was competing definitions of value (technical value vs. profit value). When GenData technically proved a concept, it expected SpecOps to move to pilot. Yet, SpecOps would only move potentially profitable projects forward. Consequently, 2–3-week sprints dragged on for months as SpecOps continuously asked GenData to test new ideas, and GenData came up with new features in response.

Ultimately, the Competitive Intelligence project did not pass the proof-of-concept stage because SupplyCo's Sales BU did not recognize its value. Political issues abruptly halted the Driver Retention project and resulted in Human Resources addressing Driver Retention internally. Despite many roadblocks, SupplyCo implemented the Trailer Advertising project. The project has generated significant revenue, with annual revenue projections. In addition to the fees SpecOps paid to participate in the innovation lab, the Trailer Advertising project's success gives GenData a successful project they can use to attract other clients.

GenData attempted to use the innovation lab approach to reposition itself from SupplyCo's technology vendor to its innovation partner. In this effort, GenData invested significantly in its relationship with SupplyCo, teaching its management about analytics, design thinking, and use cases. Unfortunately, SupplyCo did not reciprocate entirely and continued to view GenData as a vendor. SupplyCo's management took advantage of the free GenData workshops and lab pricing. When it was time to sign contracts for more extensive work, SupplyCo took projects internally or actively bid out projects when they considered GenData too expensive.

## Discussion: Towards a process theory for shadow analytics

Having described the case, we shall now answer our research question: *How do BU managers, outside the purview of IT, realize value from analytics?* Using sensemaking theory as an interpretive lens, Fig. 1 shows how the process unfolded, and Table 4 maps this process to three phases of shadow analytics discovered in the case: covert, surfacing, and overt. The discussion below builds a process theory of shadow analytics by discussing the sensemaking mechanisms apparent in each project phase, triggers, enabling conditions, and outcomes. Our research leads to three observations about realizing value from shadow analytics:

- First, realizing shadow analytics value is more complicated than BU managers initially perceive. It involves more than bypassing the IT department, choosing the right project, and evaluating vendors.
- Mechanisms such as experimentation, co-evolutionary adaptation, and conflict & conflict resolution can reshape project ideas into analytics services that generate value.
- Realizing shadow analytics value involves a 3-phase sensemaking process that redefines organizational structures and sets organizations on the path towards digital transformation.

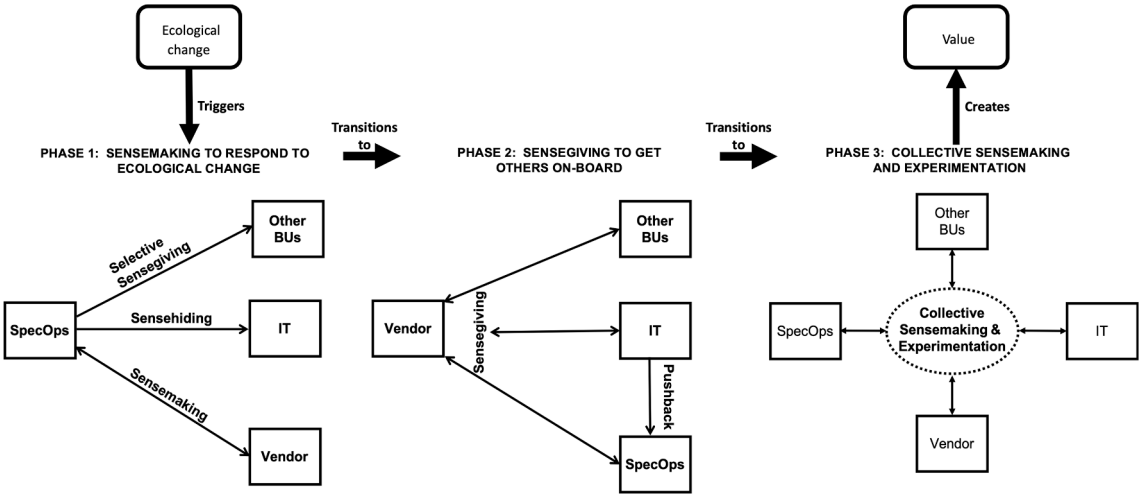


**Fig. 1.** The Path Towards Analytics Value Realization When BU Managers Lead the Effort and Bypass IT.

**Table 4**
Sensemaking in the Path Towards Realizing Shadow Analytics Value.

| | | Sensemaking Phase | | |
|---|---|---|---|---|
| | | **Phase 1: Sensemaking to Respond to Ecological Change** | **Phase 2: Sensegiving to Get Others On-Board** | **Phase 3: Collective Sensemaking and Experimentation** |
| Trigger | | SupplyCo was interested in using analytics to improve its eroding profit margins. | GenData, an analytics vendor, changed its business model | SpecOps recognizes that designing analytics products and services is a sensemaking process and that even though they hired an analytics vendor, they must still involve SupplyCo's IT department |
| Enabling Conditions | SpecOps | Resources: Entrepreneurial mindset and innovation ability<br>Technical: Ability to acquire outside IT skills and the ability to limit the IT department's interference | | |
| | Perceptions of the IT Department | Lacking technical skills in analytics, lacking entrepreneurial ability, obstructionist, and low status | | Able to provide insight on leveraging existing technology resources |
| | Characteristics of the IT Department | Cost-focused, few resources, and stability-focused | | |
| Outcome | | *Covert Shadow Analytics* resulting in a stalled project | *Surfacing Shadow Analytics* resulting in conflict, changes in identity, and changes in organizational structures | *Overt Analytics* resulting in conflict, identity changes, and new mechanisms. The process creates a new service that generates revenue. |

*Phase 1: Sensemaking to respond to ecological change*

In the SupplyCo case, the burgeoning analytics phenomenon, covered incessantly by the media and its potential to help SupplyCo's eroding profit margins were the ecological changes that triggered SpecOps to launch shadow analytics. SpecOps believed analytics was necessary to transform SupplyCo and that they were better equipped than SupplyCo's IT department to lead this transformation. Table 4 above shows the conditions enabling SpecOps' capabilities in contrast to the perceptions and characteristics of the IT

department. Initially, SpecOps believed they could create analytics value by evaluating options and choosing the right path. As they gradually made sense of what they learned, ambiguity and uncertainty increased.

Perceiving its internal IT department as its largest obstacle, SpecOps hid sense from IT. SpecOps did not want IT to know they were launching an analytics project because SupplyCo's organizational structure put analytics in IT's span of control. That control would lead to IT interfering with SpecOps' analytics project. Because of its resources, including entrepreneurial and innovation abilities, SpecOps believed it was better equipped than SupplyCo's IT department to realize value from analytics. SpecOps acquired the resources it lacked by first hiring its own IT analysts and then contracting with GenData, who could provide skilled data scientists, project managers, data, tools, and computing power. SpecOps' entrepreneurial abilities provided discretionary funds to acquire these resources and a mindset to conceptualize analytics projects that would pay for themselves, thus yielding more revenue for innovation.

SpecOps' abilities combined with SpecOps' perceptions about IT and the IT department's characteristics led to SpecOps bypassing IT, creating *covert shadow analytics*. Covert systems are hidden (Haag and Eckhardt, 2017). SpecOps perceived that IT lacked enough technical prowess, lacked in entrepreneurial ability ("IT can't move forward with projects like this because they don't know how to monetize them"), and generally was a low-status BU compared to SpecOps. Given that IT was a cost-center and management frequently cut IT's budget, IT was aggressively cost-focused, as evidenced by IT's relentless drive to purge old data, even against the modern backdrop of organizations yearning for opportunities to transform data into strategic value. Such aggressive purging of old data highlights IT's role as an obstacle in advancing SupplyCo's strategic interests. Fig. 1 shows that in addition to hiding sense from IT, SpecOps gave sense to Merchandising, the BU whose buy-in was necessary to launch the project. Through selective sensegiving, SpecOps tried to influence Merchandising's sensemaking towards a future vision of using analytics to improve buying processes.

*Phase 2: Sensegiving to get others on-board*

GenData triggered the sensegiving phase by pivoting its business model. GenData's new business model provides a solution for the difficulties of specifying analytics projects' requirements. Therefore, in this phase, GenData and SupplyCo went through a process of *co-evolutionary adaptation.* Fig. 1 shows GenData, the vendor, as a central hub in a reciprocal sensegiving relationship with SupplyCo BU's. GenData shared its new analytics capabilities with SupplyCo's BUs. In turn, SupplyCo's BUs shared their sense of how SupplyCo might use analytics. This sharing addressed two issues leading to clients not moving forward with analytics projects. Clients struggled to understand how analytics could help their business. When clients did come up with analytics applications, they approached them from a departmental perspective —without the necessary organizational-wide involvement.

This sensegiving caused the analytics project to "surface," which prompted conflict and identity change. Conflict emerged when SupplyCo's CIO received invitations to the design thinking workshops from SpecOps. She wondered why SpecOps facilitated these workshops when analytics fell into the IT departments' span of control. She further wondered why GenData, a vendor IT had worked with for decades providing SupplyCo's technology infrastructure, worked with SpecOps when she believed the IT department controlled SupplyCo's relationship with GenData. The CIO's concerns prompted pushback from IT, including efforts to control the analytics vendor, SpecOps, and the ensuing analytics projects.

IT's pushback subsided when viable projects surfaced from the design thinking workshops. Of SupplyCo's BUs, only SpecOps had a budget to pursue the recommended projects. At this point, identities began to change: IT realized that it should allow BU-led, technology-based innovation to occur even if IT's limited budget and role as a cost-center prevented it from leading the project. IT's new mindset gave SpecOps credibility in its pursuit of analytics-based innovation. Through these workshops, GenData changed its identity from a technology provider to an innovation partner. With its former identity as a technology provider, GenData's pricing and project model assumed that all client ideas were feasible. As an innovation partner, GenData charged clients for creating the proof of concept and clarified that some ideas might not make it past this stage.

*Phase 3: Collective sensemaking and experimentation*

Although the different stakeholders still had competing interests and conflicts among them remained, in the innovation lab, they shared a collective identity to create analytics projects that increased SupplyCo's profit. This shared identity helped the stakeholders embrace collective sensemaking and experimentation and cope with the tensions and conflicts this process created. The stakeholders' understanding of realizing analytics value had progressed from the initial phase, where SpecOps thought value realization was about "the influence of evaluation and choice" to understanding analytics value realization as an "interplay of action and interpretation" (Weick et al., 2005, p. 409). This evolution reduced the pressure for "for truth and getting things right" (Weick et al., 2005) by recognizing that the path towards realizing value from analytics involved experimentation.

Given that each stakeholder had unique backgrounds and interests, conflict dominated the collective sensemaking phase. Nowhere was the conflict more apparent than between SpecOps and GenData. Though the two organizations had similar project goals, their business objectives differed. SpecOps wanted to create and realize value with an analytics project. SpecOps defined value as the project generating revenues that exceeded GenData's fees. GenData' wanted to technically prove that a project would work without considering the impact of GenData's fees on the projects' financial viability. This ongoing conflict and efforts to resolve it benefitted both parties and resulted in SupplyCo realizing value from an analytics-based Trailer Advertising service. GenData now had a success story to share with clients and investment analysts as it repositioned itself from a technology provider to an innovation partner

The process of realizing value from the Trailer Advertising service set SupplyCo on a path towards digital transformation by creating new mechanisms *(experimentation, co-evolutionary adaptation, conflict, and conflict resolution)* and altering organizational structures. Regarding organizational structures, BUs role in technology projects, and IT's role in the organization changed. The IT

department realized they no longer controlled the expertise and authority associated with new technology projects ("the sense"). Further, IT realized they could overcome the cost-constraints that kept them from innovating by helping BUs that did not have the same constraints. As a result, BUs like SpecOps now faced fewer constraints pursuing digital transformation. SpecOps' perceptions of the IT department evolved from an obstacle to a resource that could provide expertise and data resources to support overt analytics.

## Implications for research and practice

By studying SupplyCo's path towards analytics value realization, this study has implications for digital transformation research and practice, which is not well understood (Sebastian et al., 2017; Vial, 2019). Digital transformation involves organizations using digital technologies [like analytics] to extend their business model, improve their relationships with customers, and create new organizational structures to provide digital services (Vial, 2019). Our study contributes to digital transformation research (Vial, 2019) and, more specifically, research at the intersection of analytics value realization (Abbasi et al., 2016; Günther et al., 2017; Mikalef et al., 2018) and shadow systems (Furstenau et al., 2017) by providing concrete, contextual examples (Walsham, 2006) of how digital transformation unfolds in practice (Vial, 2019).

In this research, neither organization set out with a digital transformation strategy; instead, they engaged in a vendor-client relationship focused on an analytics project. Our case illustrates emergent strategy making and guides scholars investigating digital transformation. Organizations do not have to launch digital transformation with a defined goal and significant investments of time, technology, and money. Rather, digital transformation can evolve emergently as organizations continuously improve how they realize value with digital technologies like analytics and big data.

By investigating both formal and informal dynamics in and outside the organization, our implications extend previous analytics value research beyond technical issues focused on making sense of vast amounts of data (Grover et al., 2018; Günther et al., 2017; Mikalef et al., 2020). Specifically, we offer a concrete definition and illustration of analytics value realization to literature that uses value creation and realization somewhat interchangeably (Chen et al., 2015; Grover et al., 2018; Günther et al., 2017). Research recognizes that organizations may not possess the capabilities to internally launch analytics initiatives (Janssen et al., 2017; Sharma et al., 2014). However, most studies do not address interorganizational collaborations or BUs outside of IT launching shadow analytics (Conboy et al., 2020; Dremel et al., 2020; Gupta and George, 2016, among others). The paragraphs below offer implications to the mechanisms and organizational structures that may facilitate analytics value realization (Grover et al., 2018; Günther et al., 2017; Mikalef et al., 2018; Wang et al., 2019).

### *Mechanisms for analytics value realization*

Our research extends literature suggesting the mechanisms that may explain analytics value realization (Abbasi et al., 2016; Grover et al., 2018; Günther et al., 2017; Mikalef et al., 2018; Seddon et al., 2017). We add insight to 1) experimentation and 2) co-evolutionary adaptation, and 3) introduce conflict and conflict resolution as an additional mechanism. Our research shows how *experimentation* leads to analytics value realization (Grover et al., 2018). Effective experimentation facilitates collective sensemaking. When BUs initiate shadow analytics to avoid interference from the IT department, collective sensemaking is brought about by a gradual process that involves sensehiding and sensegiving by change agents, as shadow analytics surfaces from covert to overt.

In our case, the analytics vendor instigated intentional experimentation through a series of workshops by which they repositioned themselves from vendor to innovation partner. *Experimenting* involves first convincing the client that analytics success involves taking risks and experimenting on a small scale (Dremel et al., 2017). Collective experimentation includes additional components, such as the vendor (1) building experimentation into its contracting mechanism by charging clients for the proof-of-concept phase and (2) securing resources and creating processes to enable experimentation. Resources included an innovation lab, data resources, and human talent (data scientists, industry experts, and design thinking experts). Processes included design thinking workshops (Svahn et al., 2017), efforts to engage SupplyCo's BUs in cross-functional collaboration (Wang et al., 2019), and an agile methodology (Chanias et al., 2019).

Our case describes how *co-evolutionary adaptation* may lead to analytics value (Grover et al., 2018). The co-evolutionary adaptation involved several sensemaking phases that helped SupplyCo build and realize analytics capabilities by negotiating failure, gaining experience, and ultimately creating an analytics service that generated revenue. The elements that enabled co-evolutionary adaptation include small-scale experimentation (Dremel et al., 2017, 2020), risk-taking (Dremel et al., 2017), sensehiding, and entrepreneurial ability. By starting the project on a small scale and hiding it from most of the organization, SpecOps took some risks and failed in a culture with limited tolerance for failure. SpecOps' entrepreneurial ability allowed it to overcome the limited innovation budget and cost constraints that stifle innovation in many IT departments (Haffke et al., 2017) by funding the experiments internally within the BU, rather than seeking budgetary approval.

Even as different stakeholders engage in collective sensemaking, conflict ensuing from competing interests may remain. Our case illustrates that the *conflict & conflict resolution* process was healthy and enabled SupplyCo to realize value from analytics by creating a scaled-down project that reduced GenData's fees. The conflict resolution mechanism advances research by identifying the tensions organizations face realizing value from analytics (Marabelli and Galliers, 2017) in inter-organizational collaborations.

### *Organizational structures supporting analytics value realization*

Our findings provide clarity on how to change legacy organizational structures to support analytics value realization (Dremel et al.,

2020; Erevelles et al., 2016; Gunther et al., 2017). The difference between phase 1′s outcomes – in which SupplyCo separated IT from the BUs – and phase 3′s outcomes – in which the analytics vendor facilitated greater fusion - provides empirical support for research suggesting fusion approaches to IT governance (Chanias et al., 2019; Vial, 2019). In addition to demonstrating the merits of IT-BU fusion, our study shows the path towards this fusion, which is problematic given that IT-BU separation "is so ingrained in the fabric of the organization that it has become part of the organization's values" (Haffke et al., 2017, p. 127). The ingrained value of IT-BU separation is evident in the analytics literature, which recommends centralized governance of analytics (Tallon et al., 2013) and the shadow systems literature, which initially focused on IT departments controlling shadow systems (Klotz et al., 2019). Our research shows that centralized IT governance leads to shadow analytics, and pulling analytics out of the shadows can enhance its value. Sensegiving, sensemaking, as well as temporary sensehiding, are processes that can help change organizational structures.

Although other case studies have not explicitly studied shadow analytics, they have examined how organizations realize value from BU-initiated analytics projects. The tensions we observed in our study are similar to those uncovered by other case studies. Like SpecOps in our study, the organization in Chanias et al.'s (2019) study also had a special BU tasked with digitally transforming its operations. In that study, management also viewed the IT department as lacking the right competencies and mindset to embrace and execute analytics, resulting in management sidelining IT in the digital transformation project. In Dremel et al.'s (2020, p. 7) study, the marketing department initiated the analytics project because they deemed the IT department as having "limited capability to design and operate big data infrastructure." These case studies and others (Janssen et al., 2017; Wamba et al., 2015) mirror phases 1 and 2 in our case, where IT is not fully involved in the analytics project. These findings suggest that traditional IT departments may initially be ill-equipped to realize value with analytics.

This situation calls into question IT's role in the organization and BUs role in IT projects. When organizations attempt a digital transformation, should they rethink the separation of IT and BUs (Agarwal and Sambamurthy, 2002; Guillemette and Paré, 2012; Valorinta, 2011) and move towards fusing IT into digital transformation strategies? Our research shows that separating IT and BUs may lead to BUs bypassing IT, which is an ineffective strategy. Organizations can move from IT-BU separation to IT-BU fusion by taking actions that lead to collective sensemaking. Our research corroborates studies (Chanias et al., 2019; Dremel et al., 2020; Wamba et al., 2015) showing that the following actions can lead to a greater fusion between IT and BUs: creating interdepartmental bodies, reconfiguring IT structures to support digital transformation, and building IT capabilities throughout the organization.

*Implications for practice*

In the paragraphs that follow, we offer practice implications that may accelerate organizational pathways to realizing value with analytics projects. First, organizations must shift how they think about analytics projects. Top leadership should drive this thinking, so it permeates the entire organization and includes the following ideas. The pathway to realizing value from analytics involves a complex evolutionary process requiring involvement from multiple stakeholders, internal and external to the organization. This evolutionary process requires that organizations redefine IT vendors' roles from service providers to innovation partners and understand that value with analytics may not come immediately. The vendors' role should shift from building technology to working with the organization on developing project concepts. Analytics value may evolve as a collaborative process punctuated with experimentation, trial and error, stakeholder conflict, and success and failure experiences.

This broad shift in mindset can inform best practices in analytics projects. First, SpecOps' actions suggest that analytics projects may flip the traditional notion of IT project management biased towards sequentially defining project requirements, meeting return on investment criteria, designing solutions, and final implementation (Project Management Institute, Inc., 2017). In the world of analytics, organizations may be unable to follow these deliberate steps because "they don't know what they don't know." Moreover, the case study suggests that managers involved with analytics embrace emergence (Chanias et al., 2019), such as engaging in design thinking and experimentation, where failure is part of the process.

A second implication is that management needs to re-evaluate organizational roles and responsibilities, mainly traditional notions that the IT department owns or drives digital transformation (Chanias et al., 2019). Instead, management should recognize that digital transformation projects may emerge through technology-savvy BU managers (Haffke et al., 2017). IT and BU managers should not view one another as outsiders or obstacles to driving digital transformation; instead, both groups should view one another as critical partners with views and perspectives essential to digital transformation. Concerning analytics initiatives, IT managers need to view BU managers as critical stakeholders due to their valuable domain expertise and ability to define analytics use cases.

A third implication for IT has to do with role expectations within the broader context of the organization. As seen with SupplyCo, their IT department operates as a cost-center focused on maintaining legacy systems, increasing efficiency, and reducing costs. Internal BUs did not view IT as capable of driving analytics or digital transformation, nor was IT inclined to do so due to budget constraints and its cost-focused mission. The lesson for SupplyCo and other organizations seeking digital transformation via analytics is that they must reset traditional IT views to transition from stability to an expanded focus on agility, innovation, and profitability. This bimodal focus decomposes the IT department into two modes - traditional and agile - the former focused on stability, the latter on the speed and experimentation necessary to support innovative IT uses in a digital business context (Haffke et al., 2017).

This transition is essential for IT to provide expertise in the collaborative sensemaking process critical to analytics initiatives. From the business side, the transition to bimodal IT may help BU managers recognize that the IT department is an essential stakeholder to engage in analytics projects. The notion that BUs can successfully launch shadow analytics initiatives through selective sensehiding and cutting IT out of the loop does not appear a viable strategy. Instead, we suggest an IT-BU fusion approach, where IT and BU managers communicate early and often to identify and surface potential analytics value-realization opportunities. While simple in concept, pivoting to this approach likely involves challenges of cultural change and organizational restructuring. Changes might

include new governance mechanisms to define processes, roles & responsibilities, and new structures to undergird the collaborative sensemaking process required of analytics initiatives.

A final implication deals with return on investment. The value may be initially unclear with analytics due to the evolving nature of analytics projects and the need for ongoing experimentation and piloting. As a result, management might fund the necessary experimentation and piloting essential to analytics projects and recognize that analytics value may come in the long-term. This recognition may help reduce stakeholder pressure to achieve an immediate return on investment from analytics projects.

## Conclusion

We need to consider this study's implications in light of its limitations. This research is a single case study and is not generalizable to other organizations. Rather, our findings generalize to theory (Lee and Baskerville, 2003) on the digital transformation process (Vial, 2019) and realizing value with analytics (Grover et al., 2018). Secondly, our findings are biased towards the BU implementing shadow analytics. Even though we interviewed and observed meetings with the other stakeholders, the findings would have differed if IT or the analytics vendor sponsored the study.

Studying SupplyCo's and GenData's efforts to realize analytics value raises future research questions about co-evolutionary adaptation, digital transformation, and how these processes unfold. Both SupplyCo and GenData experienced co-evolutionary adaptation in their efforts to realize analytics value. How do organizations re-deploy their learnings about analytics value realization to other problems facing the organization? How do IT managers harness the innovative capabilities of BUs rather than stifling user-side efforts under the moniker of shadow systems? How does co-evolutionary adaptation put organizations on a path towards digital transformation? What is the difference between emergent and planned digital transformation? Are there situations when one approach is better than the other?

Evidence keeps streaming that analytics initiatives have value. However, the literature has, at times, glossed over the struggles organizations must overcome to realize value from analytics. Our study's findings highlight the prominent tensions among stakeholders as they try and make sense of the analytics phenomenon. Conflicts between IT and project-initiating BUs are particularly stark, and they need negotiation if analytics projects are to proceed successfully. Conflicts among stakeholders are rarely eliminated, but value realization from shadow analytics projects is possible as long as effective collective sensemaking structures are present.

## Appendix

### *Appendix 1:. Study Assessment*

Researchers should assess this study's quality using principles for conducting interpretive research (Klein and Myers, 1999; Walsham, 1995) rather than traditional notions of objectivity and reliability. In the table below, we highlight how our study meets these principles.

| Principle | | Definition (Klein and Myers 1999) | Application/Evidence |
|---|---|---|---|
| 1 | Hermeneutic Circle | An interpretation process that involves moving from a precursory understanding of the parts to the whole and a global understanding of the whole context to an improved understanding of the parts (p. 71) | As we analyzed the data, we iterated back and forth between critical events and experiences in the analytics project and how this related to the broader context of the relationship between SupplyCo's BUs and SupplyCo's relationship with technology vendors. |
| 2 | Contextualization | Requires that the study sets the research in its social and historical context so that the audience can see how the current situation under investigation emerged (p. 73) | Our method and case provide a background of SupplyCo, its industry, and its BUs.<br>We analyzed SupplyCo interviews from 2013 to understand how the historical relations between IT and its BUs might create an environment where shadow analytics was likely to emerge. The case uses quotes from relevant stakeholders to describe the path towards analytics value realization. |
| 3 | Researcher-Subject Interaction | Requires understanding how the research materials were socially constructed through the interaction of the researcher and the participants (p. 72) | The data we collected was part of the social interaction between the research team and the subjects. Our method section details the data collection strategies used and the interaction types that we engaged in with the study's participants. |
| 4 | Abstraction and Generalization | Deals with relating the unique data in the case study to concepts that apply in multiple situations. Case studies can lead to four types of generalizations: concept development, theory generation, implications, and insight (p. 75) | We built a theoretical framework using sensemaking theory, which we used as a lens to interpret the data. We developed the framework iteratively by going back and forth between our data and the literature. This framework coherently presents the |

(*continued on next page*)

(*continued*)

| Principle | | Definition (Klein and Myers 1999) | Application/Evidence |
|---|---|---|---|
| | | | data and draws empirically grounded and theoretically informed insights from our single case study. Our findings generalize by offering implications and insights primarily to digital transformation literature, including analytics value realization and shadow systems. |
| 5 | Dialogical Reasoning | It requires that the researcher explain the preconceptions that guided the original research design. | The method section explains that we initially set out to study implementing a successful predictive analytics project. When this project floundered, partly because it was a covert IT project, we started studying the path towards analytics value realization for BU managers outside of IT from a sensemaking perspective. |
| 6 | Multiple Interpretations | Requires the researcher seek out, document, and highlight multiple viewpoints from participants as well as the reasons for them (p. 77) | The method section outlines how we gained insight from the SupplyCo BUs most impacted by this analytics initiative and every analytics vendor involved in the projects. See Table 2 in the method section. The case illustrates each stakeholders' different viewpoints regarding the analytics initiative and how their viewpoints changed over time. |
| 7 | Suspicion | Deals with meaning interpretation and requires the researcher to "read the social world behind the actors." Power structures and political interests characterize the social world. | Table 2 shows the actors in this study, their motivation, and their status in the network.<br>As we collected our data, we knew that SpecOps sponsoring our research likely affected some of the interview responses. We tried to alleviate this by observing meetings with these various stakeholders and sitting in the back corner of the room where our presence was less intrusive.<br>As we reflected on our interviews and field notes, we did not take them at face value. We considered the interviewees' motivations and triangulated data across multiple participants and forums. |

## Appendix 2:. Interviews

| STAKEHOLDER | RESPONDENTS & PURPOSE OF INTERVIEW | |
|---|---|---|
| **SpecOps BU** | Purpose: understanding shadow analytics and management's efforts to realize analytics value | |
| • Executive in charge of SpecOps and shadow analytics: Develops project idea, makes strategic decisions regarding shadow analytics, and funds projects<br>• Vice President: Oversees shadow analytics, works with the vendors and SupplyCo on operational and design issues<br>• Project Managers (3): Works with analytics vendors and BUs to move projects forward<br>• 10 Analysts: Develop use cases, conduct feasibility studies, and identify potential analytics vendors | | |
| **IT Department** | Purpose: understanding how IT supports BUs, in particular, user-driven technology initiatives | |
| • Chief Information Officer<br>• Vice President of Applications<br>• Director of Security and Telecommunications<br>• Application Systems Manager | | • Information Security Manager<br>• Enterprise Developer/Architect<br>• Senior Programmer<br>• Help Desk Specialist |
| **Merchandising BU** | Purpose: understand Merchandising's operations, their interactions with other BUs, and their view of the analytics initiative | |
| • Vice President | | • Director |
| **Big Data Analytics Vendors** | Purpose: understand how each vendor bids on client analytics initiatives | |
| GenData | • Grocery Industry Expert<br>• CityBeat Partnership Expert<br>• Cognitive Expert | • Client Executive<br>• Data Scientists (7)-meeting observations<br>• Relationship Manager<br>• Partner |
| SysData (no interviews, meeting observations only) | • Account Executive<br>• Data Scientists (4) | • Analytics Solutions Architect |
| VisData (no interviews, meeting observations only) | • Management Consultant (Data Science) | • Vice President of Business Development<br>• Vice President of Professional Services |
| **TOTALS** | | |
| | **Number & Length** | **Date** |
| Interviews-semi-structured and field notes | 40 interviews ranging from -15 minutes to 4 ½ hours | May 2015-February 2020 |
| Interviews-semi-structured, recorded and transcribed | 15 interviews of about 60 minutes | July 2013- September 2017 |

*Appendix 3:. Interview guide*

This appendix shows the key questions that guided our multiple rounds of semi-structured interviews with SupplyCo and GenData. Following Gioia et al.'s guidelines (2013), we tailored our questions based on the person we interviewed and the project's progression. We conducted interviews with people that we expected to know the most about the analytics initiative.

- Tell me about your role with the analytics initiative?
  - o What is going on with the analytics initiative?
  - o What are the next steps?
- Tell me about the interactions you've had with each analytics vendor and the other SupplyCo BUs this project affects?
- Let's go over the key events that have happened since the initiative's inception: what were they, how did each change your view of the initiative, what did you learn from each event, what ambiguities did each event leave you with, what actions did you take after the event?
- If you were starting over with this initiative, what would you do differently? What lessons have you learned?
- Taking a macro view, how has this analytics initiative changed your organization?

## Appendix 4:. Coding analysis examples

The table below provides an example of how we coded our data. We selected an illustrative quote for each of the main categories in our phase tables.

| Illustrative Quotes | Open Coding | Selective Coding | Theoretical Coding |
|---|---|---|---|
| With images of our competitors' facilities, we can show that we have things they do not have. For example, there are storms in Florida. We can confirm that our competitor does not have a back-up generator, which means our trucks would not get delayed. With this information, we can make our customers question who they are dealing with if they try to engage our competitor.—SpecOps EIC | Competitive Intelligence Project | Project Description | Collective Sensemaking and Experimentation<br>Describes features of the Competitive Intelligence project SpecOps ran through the innovation lab during the collective sensemaking and experimentation phase. Illustrates experimentation since the project did not progress past proof of concept. |
| One of the things that I am currently fighting for is our item numbers. They roll forward because we move such an excessive amount of products. We move about a million items a day across the nation. The problem with this is that the system does not have a high enough bandwidth to handle set item numbers for products. We also do a lot of promotions on certain things. For example, if I am selling cups at a regular value of 30 cents a pop then, we run a 5 cents promotion on them; we have to classify that as another item for our systems. This means that new item numbers are primarily assigned across the board every three months, which causes many problems with data analytics. I cannot take ten years of data and have standard numbers and data across the board. One day it is $11.71, then three months down the road, it is an $18.42 mix. If we sold 25 million of each of those, I have to find them and connect them to make that work. This makes it challenging to identify trends in our sales.—Analytics Project Manager | Recycling item numbers | Challenges Encountered | Sensemaking to Respond to Ecological Change<br>When SpecOps started shadow analytics, they learned that SupplyCo's data had integrity issues, including recycling item numbers in SupplyCo's databases. Item number recycling created an unexpected challenge that helped SpecOps realize shadow analytics wouldn't be as simple as expected. |
| Which is why the guys over on that side of the business, they're pushing and challenging us to look for new ways to make money, and part of it has to do with some of this analytics around future pricing and what does that look like, and how do we predict and project and manage and monitor. We've been doing a lot of these things, but not being from a standpoint of looking outside of our four walls to help us with that. They've brought in a couple of services, some third-party folks, to try to help with that, and we've talked with them. –Vice President, Merchandising | Building support | Stakeholder Relationships | Sensegiving to Get Others On-Board<br>Describes SpecOps inviting the Vice President of Merchandising to vendor meetings to build support for the project and learn about analytics. |
| With GenData, we have access to data sources and apps that have access to GPS locations on people's phones. We can ping phones and, based on the unique ping IDs, count how many people with cellphones saw the trailers. When we know this number, we can extrapolate to a national view count. For example, we can say, if you buy ten of our | Value proposition | New Insights | Collective Sensemaking and Experimentation Phase<br>Describes how the Trailer Advertising project will work technically and financially. This project description emerged from various |

(*continued on next page*)

(*continued*)

| Illustrative Quotes | Open Coding | Selective Coding | Theoretical Coding |
|---|---|---|---|
| trailers and you put them in high-density areas, you will get half the number of views of the World Series for approximately one–one thousandth of the cost over six months per ten trailers.—SpecOps Analytics Project Team Member | | | stakeholders experimenting with creating an analytics service. |
| What makes it work is just a lack of structure and that we really do not have a budget. At the end of the year, we produce a lot of money, but no one expects us to deliver any money. In turn, we give all of our money away. We have the flexibility to spend time on projects that may or may not work. This analytics thing may or may not work. —SpecOps EIC | SpecOps Structure | Project Uncertainty | Sensemaking to Respond to Ecological Change<br>Explains why SpecOps, not IT, was able to launch and experiment with shadow analytics. |

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