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Best Practices For Supply Chain and FTL Logistics Analytics

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An Introduction to
ATINER's Conference Paper Series

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Abstract

Analytics and the supply chain are topics important to every organization. How to get optimal value from the supply chain drives decisions across organizations both large and small. Within supply chains, logistics enables goods to move through raw material providers, manufacturing, and distribution and reach the end consumer. Being such a widely used process motivates the researchers to examine the full-truck-load logistics part of the supply chain from an analytical perspective and attempt to determine best practices for gaining optimal value that can be utilized across the entire supply chain. Transformative analytics techniques, such as multivariate regression modeling, forecasting, and others enable logistics managers to better understand the factors that go into the cost of logistics services, and thus impact decisions made to enhance value through the supply chain. In a world where logistics managers rely heavily on "gut feel", utilizing business intelligence and analytics can better enable decision making.

Keywords: Business Intelligence and Analytics, Full-truck-load, Logistics, Supply Chain

Introduction

A supply chain consists of a complicated set of raw-material suppliers, manufacturers, wholesalers, retail organizations and the end consumers of finished goods. Logistics is central to the supply chain and is how items are moved. This research focuses on full-truck-load (FTL) logistics providers within the supply chain, and what they should do as best practices and how they can be generalized. The researchers' goal is to pull together relevant literature to develop a set of proposed best practices that can then be tested within FTL logistics providers and the information flows seen in Figure.

Logistics (or shipping) providers 'services range from commercial shipping to home delivery. These suppliers include less-than-truckload (LTL) and FTL providers. Organizations in this space include FedEx, UPS, national/regional governmental postal services, and a myriad of shippers that offer LTL/FTL services. Some large logistics providers also offer a network of services that include both LTL and FTL shipping services to accommodate end-to-end shipping needs. There are also manyLTL/FTL providers that depend on third-party-logistics (3PL) companies' to coordinated-to-end shipping and often include in-transit inventory management.

There is no doubt that organizations within the supply chain rely heavily on logistic suppliers to maintain their competitive position, but what about the FTL logistics providers themselves? Our research focuses on thoseFTL providers that are used inside the supply chain. These FTL providers have unique needs, in that they are concerned with maximizing their profit while serving many shipping clients. They ordinarily do not focus on individual package shipment, but onFTL shipments of materials in the downstream portion of the supply chain.

This research focuses on the n-tier supply chain. N-tier refers to the fact that there are many potential, but unknown organizations throughout a supply chain. It has many   information   flows   as   detailed   in

Figure 1. The researchers' area of interest is shown in the box in this figure. We believe there are many FTL providers that could benefit from our proposed best practices.

FTL providershave shown they often rely on experience, rather than data to make decisions, and that many issues are solved by gut feeling and pragmatism (Kersten 2008). While decisions supported by business intelligence (BI) and analytics may not be able to replace the seasoned logistics manager, a structured set of best practices and BI should be able to support organizations and their managers in their quest to reduce costs and improve services, all of which benefit the end-consumer.

Figure 1. *N-Tier Supply Chain*
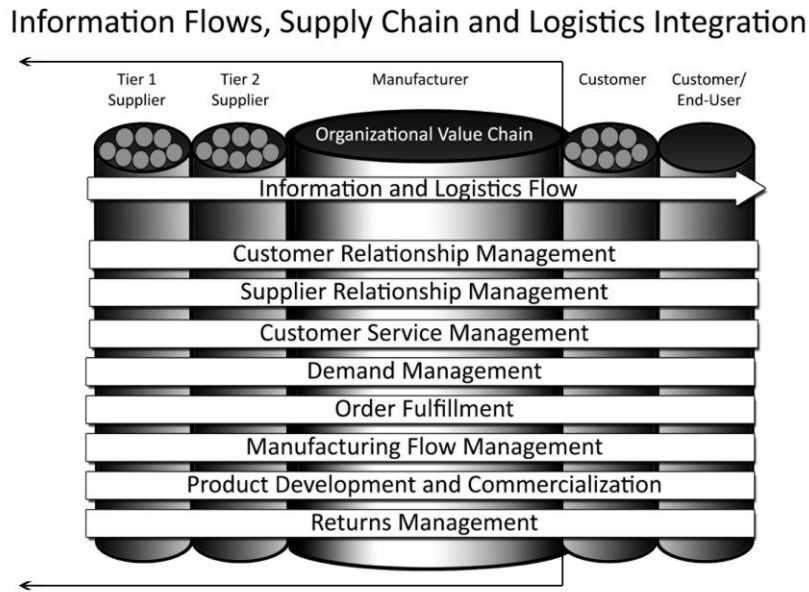
Source: Supply Chain Management Institute, 2008

Supply Chain Analytics and the FTL Carrier

The literature shows the importance of understanding the big data phenomena to the FTL carrier. This phenomenon includes data in repositories held at the FTL logistics company and an ever-increasing stream of data that comes from participants within the n-tier supply chain shown in

Figure 1. For example, those data streams come from devices like those embedded in the trucks to log driving hours and sales/inventory management systems throughout the supply chain. FTL providers are inundated by the Internet of Things (IoT) and the resultant data that needs to be understood. This applies to all organizations through the supply chain and to the logistics providers.

Analyzing big data in the supply chain is receiving increased attention due to its complexity and potential for improving business metrics. The challenges include inefficiencies such as delayed shipments, increased fuel costs, changing customer expectations and supplier inconsistencies. Developing a meaningful way to interpret this massive influx of big data is crucial. Turning big data into knowledge can provide unique insights into many aspects of the supply chain including market trends, customer-buying patterns, and even maintenance cycles. Understanding these things can lower costs and allow the FTL manager to make more targeted business decisions.

The methodologies to accomplish turning big data into knowledge are based on descriptive, predictive, and prescriptive analytics.(Wang, Gunasekaran, Ngai, & Papadopoulos, 2016) These are defined as:

- **Descriptive analytics** takes place either at standardized periods or whenever needed using techniques such as online analytical processing (OLAP) or drill down, and aims at identifying problems and opportunities within existing processes and functions.
- **Predictive analytics** involves the use of mathematical algorithms and programming to discover explanatory and predictive patterns within data. The aim of this type of analytics is to accurately project what will happen in the future and provide reasons as to why it may happen. Predictive analytics is enabled using techniques such as data/text/web mining, regression, and forecasting.
- **Prescriptive analytics** involves the use of data and mathematical algorithms to determine and assess alternative decisions that involve objectives and requirements characterized by high volume and complexity, with the aim to improve business performance. Prescriptive analytics include multi-criteria decision-making, optimization, and simulation.

Figure 2. *Supply Chain Analytics Maturity Framework*
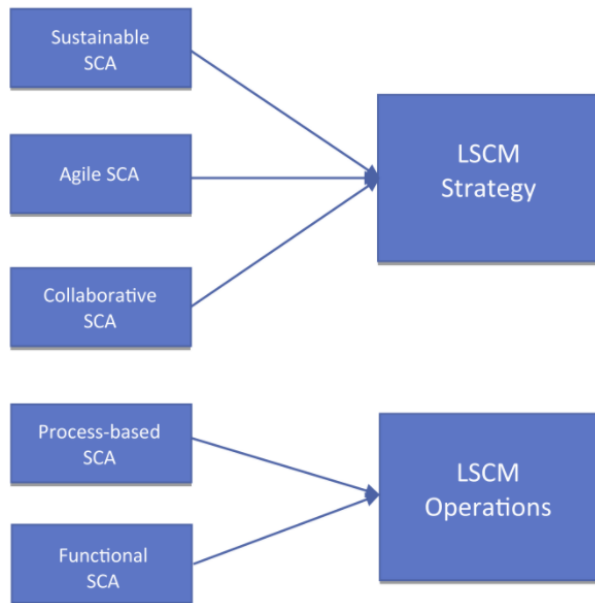
Source: Wang, Gunasekaran, Ngai, & Papadopoulos, 2016.

Wang, et. al. proposes a framework for the inclusion of supply chain analytics in holistic business analytics strategy and operations. This framework is seen in Figure 2. It describes the Logistics and Supply Chain Management (LCSM) strategy to remain sustainable from a business perspective, but also agile in the ability to adapt quickly to trends, and collaborative in the quest for knowledge and fully identifying the Supply Chain Analytics (SCA) areas to monitor/analyze for business growth to occur. This framework extrapolates the relationship between the various levels of SCA maturity to LSCM strategy and operations. Most of the frameworks and models in the field of supply chain management aim at examining and explaining processes through which supply chains improve their effectiveness. Even though SCA is extremely important in LSCM operations, it should also be integrated into other business functions such as finance, marketing, and human resources. But, to truly integrate this, it is paramount to understand the implications of SCA.

SCA helps organizations assess the performance of various areas in logistics and supply chain management and provide an established benchmark to determine added operations value. Supply chain analytics aids in an organization's ability to monitor these metrics on a continual basis, as well as find a root cause for any issues. This will deliver better business decisions and measurable process improvements. It is our belief that the smaller FTL supplier needs to be involved in SCA initiatives with their business and 3PL partners.

Review of Full Truck Load (FTL) Transportation Service Procurement

FTL transportation is a large industry that is ripe for new analytics and has many moving parts, as well as issues that can be encountered. It is common to establish long term service agreements, in the form of two or three-year contracts. This is known as contract logistics, which accounts for over 15 percent of the 1.2 trillion-

dollar global logistics market, and is broken out by country in Figure 3 below. (Ramanatan et al. 2015)

Figure 3. *Country Wise Contract Logistic Market*

S.No	Country	Contract logistic Market in Million USD
1	USA	60739
2	Canada	5786
3	UK	22332
4	Germany	19629
5	France	10241
6	China	33690
7	Japan	21163
8	India	8049

Source: Ramanatan, Subramanian, & Cheikhrouhou, 2015

However, the growth of contract logistics presents a series of issues to overcome (see

Figure 4).Four out of the five top critical issues are related to operational efficiency. The others are related to safety, congestion, finance, infrastructure, and technology. Operational inefficiency is a universal concern that must be improved. On the operational efficiency front, contract logistics purely depends on the economic situation of the country, which has a huge impact upon the customer demand as well as the freight demand.

Figure 4. *Issues in Logistics and Their Ranks*

Rank	Issues	Rank	Issues
1	Economy	6	Congestion
2	Hours of service	7	Transportation funding
3	Driver shortage	8	Tort Reform
4	Implementation of safety rules	9	Onboard truck technology
5	Fuel price	10	Truck size and weight

Source: Ramanatan, Subramanian, & Cheikhrouhou, 2015

The size of FTL shipping avails substantial many areas to employ best practices and to make a significant economic impact. Best practices are need to correct existing issues such as those in

Figure 4, and in general make the current 180 million-dollar industry run smoother.

Examples of the Impact of Good and Bad Logistics Analytics

The problems caused by not understanding the flow of logistics can be profound. Kentucky Fried Chicken (KFC) recently experienced this when a hiccup in their supply chain forced half of the Britain's 900 outlets to close. The logistics suppler indicated that the problem was caused in the supply chain and there was "unforeseen interruption of this complex service." (Freytas-Tamura and Tsang 2018). This interruption was a major logistics failure for KFC that might have been avoided if they had better understanding of their logistics operation.

We can also look at the positive impacts of good analytics. More effective management of transportation can lead to lower costs and happier customers. One such case of that is a transportation management solution like Cerasis. These products give a better visualization of data flows within the supply chain. The company RehabMart "developed a winning freight strategy, streamlining Shipping, visibility and claims in one swoop." The operations manager states that "we finally have access to the data in the Cerasis dashboard that we didn't even realize we could see. If the CEO wants to know something right now, I can login and get that information without a hassle." (Robinson, 2017) This appears to be a common response to managers getting access to information so they can make quick informed data-driven decisions.

These brief examples give strong motivation to come up with a solid set of best practices for logistics analytics.

This Paper and our Goals

This paper will first move through a review of literature which the authors' feel is important to creating a set of best practices for today's supply chain and logistics organizations. Once current relevant literature is presented, a model for FTL logistics providers to use in the day-to-day management will be proposed. The researchers' next step, after receiving feedback on our model from conference presentations and other colleagues, will be to test our proposed model with FTL organizations.

Literature Review

In this section we review recent literature that are pertinent to the proposed best practices. The proposed best practices are broken into these areas:

- Analytics Readiness
- Know Your Metrics
- Analytics to Create Value
- Understanding Your Partners

- Develop an Analytics Structure

These areas motivate our selection of the literature used to create the proposed best practices.

Logistics Management Systems and Best Practices

There has been a shift in logistics management software toward flexibility and efficiency, which necessitates that manufacturers must create logistics strategies to handle significantly more complex problems. This is described as an inside-out approach to supply chain and logistics management that differs from traditional logistics management and requires different software and best practices to support it. The goal is to create a value-driven logistics network that aligns supply and demand relationships around the right platforms and organizational and systems practices. (TechTarget, 2009) These best-practices proposed by TechTargetare a great foundation to springboard to the next level of cutting-edge best practices for the logistics industry. TechTarget proposed the following:

- **Recognize the emergence of a multi-faceted supply chain.** This includes understanding the impact of globalization; a changing global competitive landscape; mergers, acquisitions, structuring, and bankruptcies; an active and changing regulatory environment; changing consumer expectations; shorter product lifecycles; increased product configurability and customizability; rapidly changing energy costs; and more.
- **Understand internal, external, and customer logistics.** This pertains to physical aspects of the business, external factors over which the organization has little control, regulatory issues, and customer dynamics.
- **Embrace change and implement change management when deploying new logistics management software.** Recognize that jobs and responsibilities will change and the resulting new business processes may disrupt long-ingrained work habits. Expect resistance to change and implement communication, education, and change management programs from the start.
- **Aim for a dynamically resilient logistics management strategy**. You'll need this to adapt to internal and external changes as they happen through the use of logistics management software. Look for software that is highly flexible and easily configurable.
- **Strive for continual logistics monitoring and visibility.** This can be accomplished with logistics management software that enables managers to see what is happening at every step in the end-to-end process, identifies bottlenecks and problems before they impact the customer, and can respond to changes in the competitive and regulatory environments

21st Third Party Logistics Study Shows Increased Use of 3pls & Shippers

At the close of 2016, the 21st Annual Third-Party Logistics Study found the overall use of 3PL is increasing, but the types of logistics services utilized indicate the industry is entering a shift in how it operates. Since shippers rely on having the most accurate information available and applicable to their operation, understanding the trends identified in the third-party logistics study can help a business grow.

In 2002, the third-party logistics study first began surveying satisfaction with the level of information technology (IT) services available through 3PLs. The initial finding was a 22% satisfaction rating, or conversely 78% of shippers that were dissatisfied with the level of IT services being offered. In 2016 the satisfaction rating has risen to 65%t satisfied and 35% dissatisfied. This indicates more shippers are satisfied with 3PL-offered IT services, which now includes the collection, analysis and application of Big Data and predictive analytics.

Among shippers, IT services is not a direct value-added service of 3PLs; it is a necessity, reports Supply Chain Digest. With 93% of shippers and 98% of 3PLs citing that data-driven decisions, powered by Big Data and innovative technology, and the role of IT in modern logistics cannot be overstated. (Jessop, 2017).

Business Intelligence and Revenue Management

The goal of revenue management is to sell the right product, to the right customer, at the right time for the right price, to reduce surplus by estimating supply and demand, then adjusting prices and various other factors to maximize profits, as shown in Figure 5. To accomplish this, you need to combine forecasts, predictions of customer behavior, data, price fluctuation and competition prices, using analytics to optimize business profits. While revenue management is something that has been around for decades, and certainly before modern business analytics, it is important to integrate modern analytics techniques to approach a more accurate revenue management model.

Figure 5. *Revenue Management Analytics Process.*
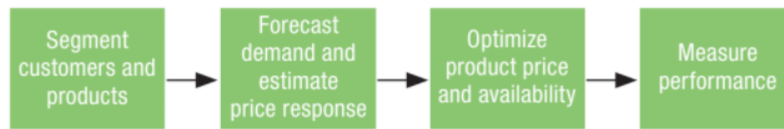
Source: Watson & Higbie, 2014

There are many examples, including FTL pricing systems, that focus on optimizing the inventory for products (e.g. shipping containers) to maximize yield. However, the FTL shipper often relies on prices determined by an external, manual process. Today, price is increasingly part of the package of recommendations, and the systems that drive operational and strategic decision making in marketing (promotional spending), budgeting, and investment. (Watson & Higbie, 2014) The FTL shipper needs to include these pricing techniques in their bids to ship goods.

Reliance on pricing systems like those within revenue management has substantial implications for the FTL provider. Adopting systems like the one shown in Figure 6, would assist FTL providers in maintaining their competitive position.

Figure 6. *General Revenue Management Systems Architecture*
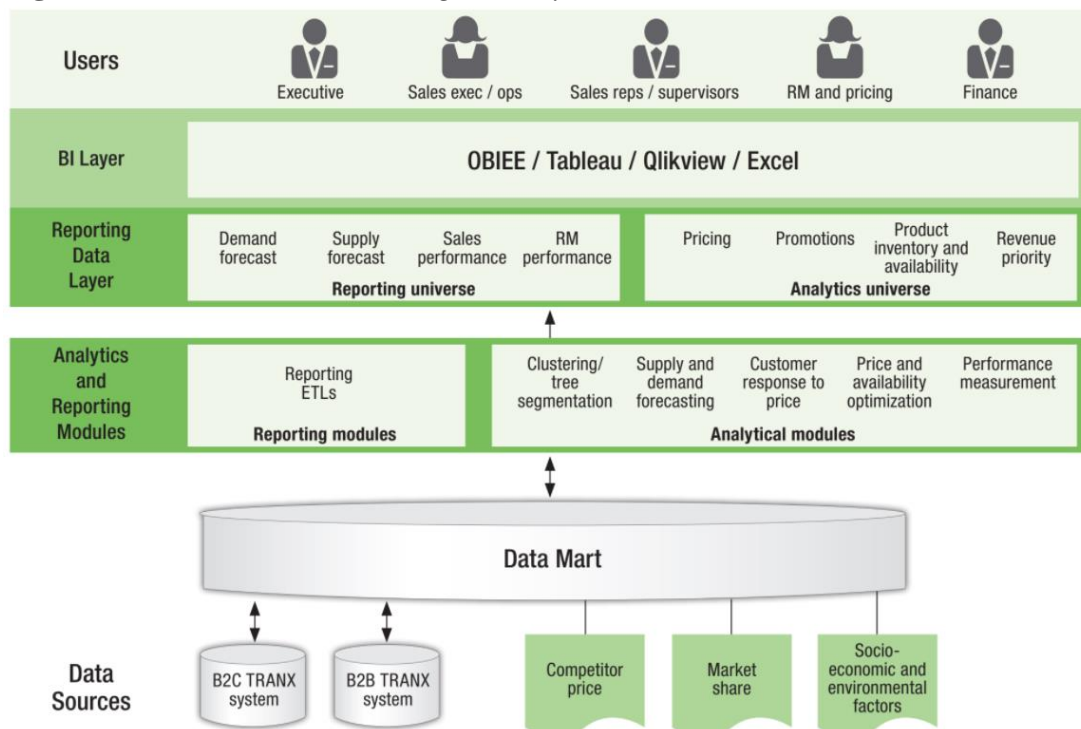
Source:

Learning from Practice: How HR Analytics Avoids Being a Management Fad

It is easy to think of analytics as a management fad. But, you can explore examples that show analytics can become a value providing activity in any

organization. An example of this is HR analytics, which has shown its value in organizational management. There are also many pitfalls that are to be avoided, including:

- **Lack of analytics about analytics:** it sounds redundant, but analytics must be used to justify the use of analytics; *is the organization getting value from their analytics activities*?
- **Mean/end inversion or data fetish:** analytics are being used simply for the sake of analytics. Analytics should not begin with data but instead with business challenges and asking the right questions; *are the right questions being asked of your analytics activities?*
- **Academic mindset in a business setting:** there needs to be an understanding of the differences between academic and practice approaches; *are the questions being asked meaningful to adding value or are they academic in nature (i.e. producing analytic output just for the sake of interest or because that is the way it has always been done, with nobona fide business value)?*
- **Analytics being run from a Center-of-Expertise (CoE):** big data is being used to uncover insights that are then "pushed" out to the businesses, but when analytics are pushed, not pulled, they seldom return expected business value; analytics must be available on a self-service business intelligence platform that allows managers to create their own intelligence; *can managers create their own intelligence rather than waiting for someone to tell them what they need to know?*
- **A journalistic approach to analytics:** analytics can be distorted to uphold the status quo by using data to advance only particular points of view; in its practical application, if analytics embraces a journalistic style of communication it often loses its business audience; *is the information produced useful in decision -making?*

FTL organizations need to combat these analytic hazards and must first begin with the business problem, not with data or a predetermined methodology to business problems. This notion proposes that data and analytics are simply smaller and cohesive parts of a total diagnostic framework. Departmental analytics cannot exist in a vacuum and must become part of existing cross functional business analytics. It is also important to remember the human factor and that data and evidence does not change anything, as neither people nor organizations are completely rational. This caution serves as a reminder that given a choice between standing beliefs and new data showing those beliefs to be imprudent, people often chooses their own belief system and discards data. FTL organizations need trained professionals to have an analytical mindset through supplemental training and hands-on projects (Rasmussen & Ulrich, 2015).

Management Challenges in creating Value from Business Analytics

Managers, including FTL managers, encounter challenges when seeking to create and add value by becoming more data and information driven. On average, data-driven companies are five percent more productive and six percent more profitable than their competitors. (Vidgen, Shaw, & Grant, 2017) Still, it can be challenging for managers to adjust their decision-making culture. Some of the questions that are hoped to be answered by theproposed FTL best practices framework include:

1. How do organizations extract or create value from data?
2. What challenges do organizations face in building their business analytics capability to extract or create such value?

Organizations must develop data-oriented management systems to make sense of data as well as address the need to create business value and competitive advantage. Data does not erase the need for human insight and vision, thus organizations face challenges in the process of becoming data-driven (Vidgen, Shaw, & Grant, 2017):

1. **Leadership:** business leaders must be able to identify opportunities, understand developing markets, think creatively, offer innovative ideas, put forth a compelling vision, and persuade people to embrace it, all while working effectively with customers, employees, and stakeholders.
2. **Talent management**: individuals with data science and visualization skills are low in supply and high in demand.
3. **Technology**: tools to manage data have improved in recent years; and while these tools are typically reasonable in cost and much of the software is open source, they do require new skills of most IT departments.
4. **Decision-making:** effective organizations and leaders understand that people need to be brought together across departments with the right data.
5. **Company culture:** requires the breaking of bad habits; making decisions based solely on hunches and instinct and then adding data later to reinforce the decision-making.

Leavitt's diamond model of organization seen in

Figure 7was used to study these challenges. It is suggested that the business analytics capability of an organization can be thought of as a mediator between the data the organization generates and accesses (internal and external) and the value the organization can leverage from that data through actions based on better decisions.

Figure 7. *Leavitt's Diamond Model ()*
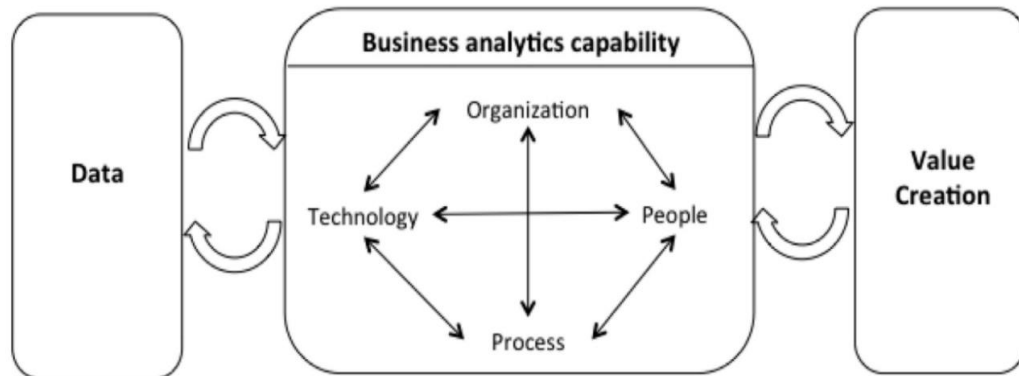
Vidgen, et. al. identified thrity-one key challenges faced by organizations during the process of building their business analytics capabilities along with twenty-one corresponding suggestions for organizations to extract or create business value. They assess how many organizations are still in a "reactive baseline analytics state", struggling with issues revolving around the data itself. This research also provides suggestions for the skills sets that are required in order for organizations to face their analytics challenges. The researchers' conclusions provide a proposed "integrative ecosystem,"which should be adopted by FTL providers. This is seen in Figure 8. This ecosystem combines data, business and organizations with an analytical approach that intersects with the creation of big data and analytics strategies to transform data into knowledge.

Figure 8. *Business Analytics as a Coevolving Ecosystem*
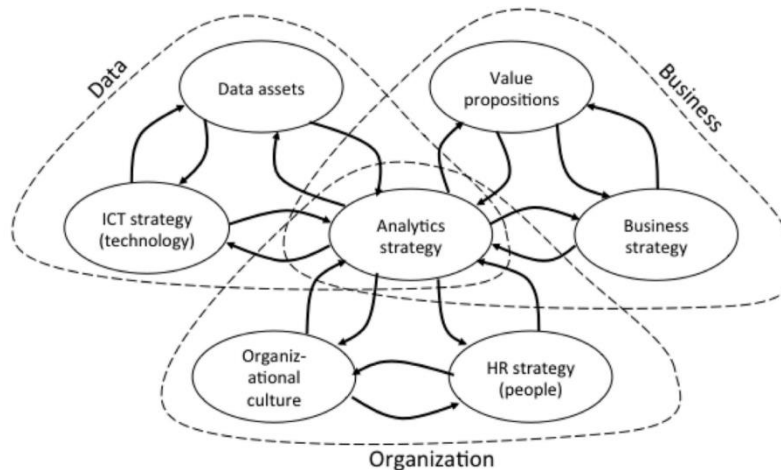
Managers need to consider data-driven strategy creation. The top five items proposed for management focus are: "data quality, using analytics for improved decision making, creating a big data and analytics strategy, making data available, and building data skills in the organization". The research also provides management

with a thorough checklist of factors to consider when developing their organization's analytics capabilities. Additionally, the research concludes that business analytics, while traditionally given to IT departments due to the technical nature of the project, is "more appropriately seen as a business transformation initiative that needs an analytics strategy, senior management support, and active and careful change management". This leads to the conclusion that actionable insight needs more than just establishing a data science team, but requires a cohesive ecosystem between departments. (Vidgen, Shaw, & Grant, 2017) This is a challenge for a well-funded organization, and is especially challenging for small FTL providers. For example, in the United States there about 110k for-hire carriers and 350k owner-operators. The industry is fragmented with the 50 largest companies providing less than 30% of the market. (US CA DOT, 2017). These points to the added pressure placed on 3PL and other logistics providers to deploy analytics services to for-hire and owner-operators.

Using Data Analytics to Capture Revenue Management Benefits in Turbulent Periods

Supply chains, including FTL providers are often managing during turbulent periods. While not specifically an FTL supplier, the airline industry provides interesting lessons to be learned when managing in turbulent periods. This industry shows how data analytics can provide substantial revenue management benefits, particularly in times of industry volatile market conditions. Analytics in the airline industry provided a short-term solution involving these three issues:

1. Creation of clusters of flights that share specific characteristics
2. Building "alerts" by cluster by time interval
3. Refining the "alerts" based on feedback and partially automating actions based on specific alert criteria (i.e. default authorizations to open flights)

The analytics solution delivered about a three percent improvement overall in revenue year over year above the budgeted fifteen percent, allowing for immediate revenue improvements without restricting or dramatic changes in fleet. This research provides valuable supplementation to revenue management systems as well as assists in forming disciplined business processes. (Jain & Bacon, 2016) The FTL organization can benefit from looking both short-term and long-term using analytics to manage the organization and create business policies that make the organization more profitable.

Transformational Issues of Big Data and Analytics in Networked Businesses

Both technical and managerial issues arise during and after adoption and implementation of analytics within business organizations. Big data in today's global economy comes from five major sources:

1. **Large-scale enterprise systems** such as enterprise resource planning (ERP), customer relationship management (CRM), supply chain management (SCM), etc.
2. **Online social graphs**; the interactions of people on social media leaves a digital trail that can be tracked, graphed, and analyzed
3. **Mobile devices;** with about5 billion devices worldwide this is a source of big data with every user action being possibly tracked and geotagged
4. **Internet-of-things (IoT);** the tracking of data when creating a physical ecosystem of sensors being connected to objects (homes, cars, delivery trucks, cargo containers, etc.)
5. **Open/public data;** data on various subjects such as weather, traffic, maps, environment, and housing is becoming more readily available.

Business analytics "encompasses all aspects of the data process to facilitate predictive and/or causal inference-based business decision-making." Baesens, et. al. suggests these three major impacts on businesses related to big data:

1. Impacting business decisions
2. Rebalancing the power of relationships in decision making in the commercial world
3. Altering the scope as well as the scale of optimization challenges

Baesen, et. al. further suggests a few innovative uses of big data such as online-to-offline commerce, networks of smart vehicles, and proactive customer care. Some disruptive impacts of big data are also discussed in such areas as business analytics retooling, the integration of data and social sciences, and the breakdown of traditional business boundaries. The value assessment of analytical techniques is also discussed and it is recommended that to gain more influence in the strategic decision-making process, it is important to bridge the communication gap between analytical models and outcomes and management members. Analytical models must be understandable by decision makers to be effective tools in strategic decision making. Additional value-based model criterion involves continued efficiency which includes model evaluation, monitoring, and updating. Finally, analytical models in business should provide positive ROIs by adding "economic value by either generating profits or cutting costs or both". (Baesens, Bapna, Marsden, Vanthienen, & J., 2016)

Framework for Transportation Procurement

A logistics framework for transportation procurement can be seen in Figure 9. This framework breaks transportation into FTL, LTL and Spot Market, heavily focusing on FTL, highlighting the primary areas and assesses the issues around them. This FTL procurement framework exhibits two major modelling issues known as:

1. the bid generation problem (BGP)
2. the carrier assignment problem (CAP)

Both revolve around shipping lanes in which the optimal allocation increases significantly depending on the number of lanes assigned, while still trying to operate as efficiently as possible. In an ideal world, this can be accomplished by collaboration between the shippers and/or among carriers. (Ergun, Kuyzu, & Savelsbergh, 2007). BGP is solved by the carrier (bidder) with the general objective of maximizing the profit. In this stage, the carriers have to decide on the shipping lanes they have to bid for and on their rate. This leads to the complex combinatorial optimization problem. The problem of CAP consists of finding the optimal allocation of shipping lanes to the bidders that minimizes cost. (Ramanatan, Subramanian, & Cheikhrouhou, 2015)

Figure 9. *Framework for Review of Truckload Transportation Procurement*
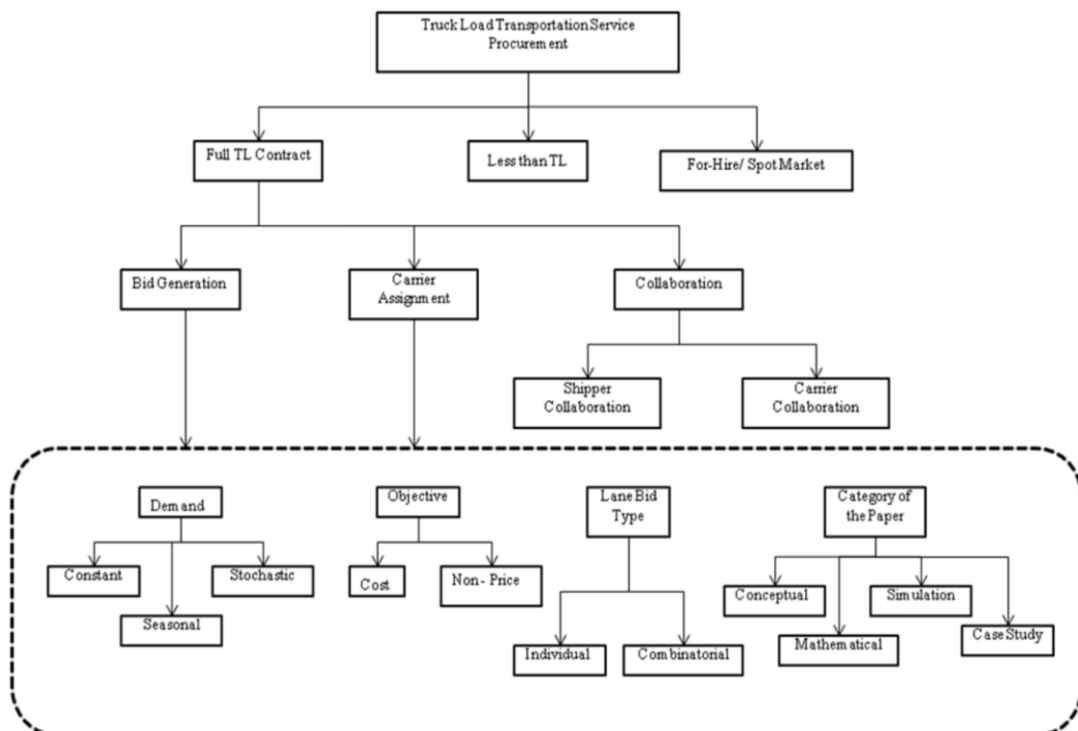
Source: Ramanatan, Subramanian, & Cheikhrouhou, 2015

FTL transportation service procurement is an important logistical activity, as it will highly impact logistics cost and customer service. The logistics framework associated with this work does an excellent job laying out the Full Truck Load contract market.

Cultural Competency

Cultural competency is a critical issue in our global economy. Thomas Friedman, a leading foreign affairs journalist, stated the current era of globalization started recently. "Today's era of globalization is built around falling telecommunications costs – thanks to microchips, satellites, fiber optics and the Internet. These recent technologies are able to weave the world together even tighter (Friedman, 2000)."

The Internet increased the ability for information sharing. Globalization creates the demand for culturally sensitive managers as well as culturally sensitive information sharing. Organizations are increasingly implementing connections to foreign partners to create competitive advantage. Globalization has forced organizations to implement these connections with a variety of cultures. The need for cultural competency is felt by small FTL providers, especially as they use 3PL providers who may cause greater interaction with the global economy, and for larger FTL providers who may already network globally. These global interactions create a value-web of organizations and individuals that need to interact and understand each other; cultural competencies are the foundation of that understanding. In this section we will cover a small portion of the literature which is relevant to the cultural competency of the FTL manager.

Culture: Differences and Sensitivity

A broad definition of cultural sensitivity is "being aware that cultural differences and sensitivity exist and have an effect on values, learning and behaviors" (Stafford, Lopes-DeFede, Bowman, Hanna, & Eking, 1997).Cultural sensitivity can be further defined as having two dimensions: surface and deep structure. Deep structure is defined as incorporating the cultural, social, historical, environmental, and psychological forces that influence the target behavior in the proposed population (Resnicow, 1999). Our best practices focus on the deep structure of culture by factoring in the numerous forces that influence a country's culture.

A four-stage model useful in understanding cross-cultural sensitivity was developed for international business relationships (Shapiro, Ozanne, & Saatcioglu, 2008). Each stage represents a level of cultural sensitivity, including the necessary skills and benefits. This allows a manager to analyze the level of cultural sensitivity in an employee. The four stages are further explored in Figure 10. Defining cultural sensitivity levels provides a framework to compare a manager's ability to implement the best practices for information sharing. Managers at a higher level will have easier time delivering information across global boundaries as they have the knowledge needed to understand the importance of culture.

Communication Style

A key factor of cross-culture communications is perception, or how things are viewed. There are two major styles of cultures, high-context and low-context: (Hall, 1976)

- High-context: "is one in which little explicit message context is needed because most of the information is based in the context." For example – a presentation that gives the facts about a service and leaves the viewer to make their own decision that a service is of high quality.
- Low-context: "…much explicit message should be said or written in communication because the context does not covey much meaning". For

example – a presentation which tells the viewer that a service is of high quality and may give some supporting facts.

This ties directly to why cultures view information differently. Studies found that eastern countries are often high-context, whereas western countries are traditionally low-context (Li & Putterill, 2007). This was reinforced by a study that compared differences in cross-cultural communication styles to determine whether countries are high-context or low-context. Eastern countries were found to be considered high-context, while the U.S. and western regions are low-context. When creating information to be presented to a high-context culture, there is little reason for explicit message context as they observe the message. The information instead uses implicit messages to convey the target message. Inversely, a low-context culture requires significant explicit content to ensure the message is received. (Bourne, 2016)

Figure 10. *Four Stages of Cultural Sensitivity*

Stages	Attitude & Cultural Depth	Cultural Sensitivity	Business Relationships & Strategies	Forms of Trust
1. Romantic sojourner	• Fascination • Shallow, daily contact, tourist	• Declarative & procedural knowledge	• Discrete, profit-based • Opportunistic	• Uncalculated risks • Naïve trust
2. Foreign worker	• Immersion in business culture • More realistic attitude • Ends in disenchantment and cultural shock	• Begin to develop emic knowledge • Initial emergence of scanning skills and enacted procedural knowledge	• Trail-and-error based but developing relationships • Constructed frames of meaning are tactical	• Competence, integrity, & reliability trust • Trust violation result in relationship dissolution
3. Skilled Worker	• Deeper cultural contact • Skillful diplomats • Evolution to outsider status	• Frustration ends as emic knowledge structures develop • Skillful enacted procedural knowledge and scanning	• Business-bounded relationships but expanding to interpersonal • Greater self-efficacy	• Reliability, integrity, and competence trust still important • Emerging benevolence trust
4. Partner	• Very deep immersion within the culture • Balanced and respectful yet re-enchanted	• Cultural reflexivity • Situated knowledge of cultural differences	• Negotiated business culture as a third way of knowing • High self-efficacy	• Benevolence trust • Relational trust • Other forms of trust become less important

Source: Shapiro, Ozanne, & Saatcioglu, 2008.

Top 10 Best Practices For Next-Gen Analytics

SAS is a world leader in analytics and software solutions, and created a list of next-gen best practices for analytics, below. While these are not directly geared at logistics, they can be certainly be utilized in a logistics world. It was stated that "Next-generation analytics might move your organization from visualization to big data visualization; from slicing and dicing data to predictive analytics; or to using more than just structured data for analysis," which is in alignment with what we are trying to accomplish from a logistics perspective. (Beall, 2014)

1. **Realize there is no silver bullet, but don't do nothing:** Building an analytics culture using next-generation analytics and putting the ecosystem together takes time. It's important not to try to boil the ocean. However, it's also important not to ignore the work and simply hope success will magically happen. Companies that are measuring value with analytics are taking risks, experimenting, and finding success. They're evangelizing and communicating. It may take time, but they're certainly getting there.

2. **Consider new infrastructure technology:** Companies succeeding with next-generation analytics are putting together an ecosystem that consists of multiple technology types. Yes, this can include the data warehouse (don't expect the new stuff to replace the old), but it should also include the right tools for the jobs, including in-memory computing for highly iterative analysis or the cloud to deal with vast amounts of data that might be generated in the public cloud and on premises.

3. **Consider more advanced analytics:** Companies measuring value are using more advanced analytics. Although this requires skills and training, the upside is clear. Often a good first step into the world of advanced analytics is predictive analytics. Vendors are making the tools easier to use, and with the right controls in place, this can be a good place to start.

4. **Start with a proof of concept:** Companies succeeding with predictive analytics often start with a metric they're already measuring, so they can demonstrate that they can predict that metric -- they know it's valuable and will get attention.

5. **Utilize disparate data:** Although structured data and demographic data are the mainstay of analysts and modelers, disparate data types can enrich a data set and provide lift to models. Think about incorporating data beyond the traditional types you might have in your data warehouse or on your servers. Good starting points include geospatial data and text.

6. **Take training seriously:** The democratization of analytics is moving ahead. However, you need to think about the skills you'll require for data management, as well as the skills to build your models and deal with your data. With statisticians and other quants in short supply, think about what skills you'll need for the kinds of models you want to build. Part of the process is balancing the costs and benefits of the models you're considering. Allocate your resources wisely. Training will become an important part of your next-generation strategy.
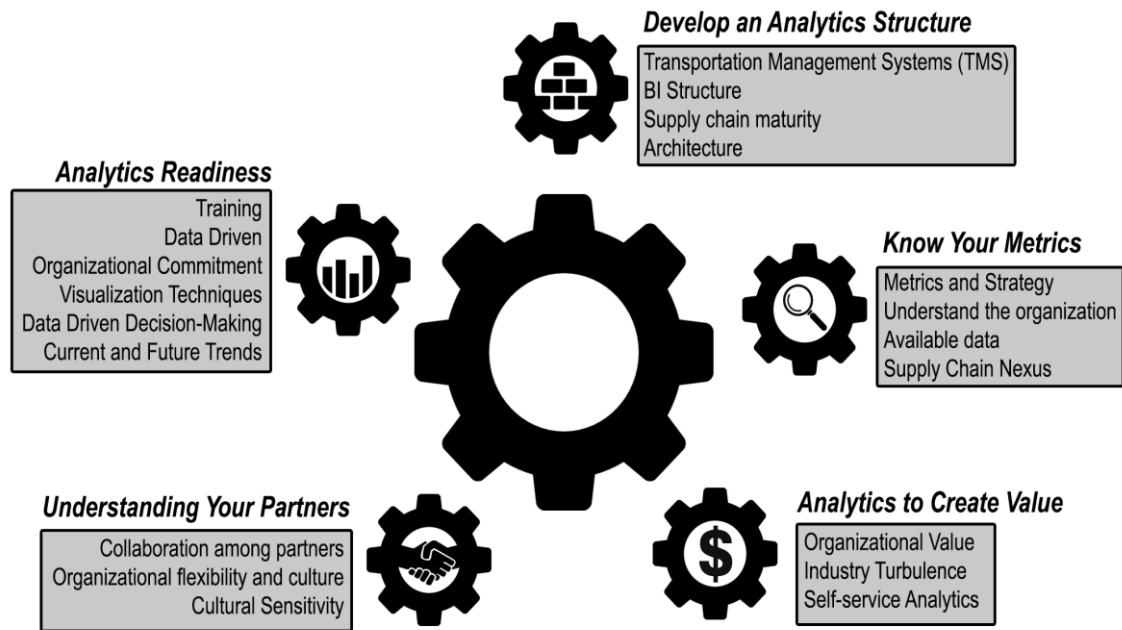
7. **<u>Put controls in place:</u>** Democratization means that business analysts will try to use more advanced technology. Make sure controls are in place before a model is put into production. This might include confirming the validity of a model.

8. **<u>Act on your data:</u>** Analytics without action won't yield measurable impact. Even if you aren't ready to operationalize your analysis, it makes sense to start implementing a process to take action, even if it's manual action. You'll be building a more analytically-driven culture for when you want to build more operational intelligence.

9. **<u>Build a center of excellence:</u>** A CoE can be a great way to make sure that the infrastructure and analytics you implement are coherent. CoEs can help you disseminate information, provide training, and establish or maintain governance.

10. **<u>Remember to monitor your analysis:</u>** Data can get stale. Models can get stale. It's important to revisit any kind of analysis where action is taking place on a periodic basis to make sure that your data is still relevant and that your model still makes sense.

Proposed Model for FTL Best Practices

Based on the literature cited above and the combined experience of the authors and others, we propose a set of best practices below. These best practices can be generalized and applied to many different areas of the supply chain depending on the application of the individual organization, and they can also be seen in Figure 11. These best practices are:

Figure 11. *Full Truck Load Best Practices*

Full Truck Load Supply Chain Best Practices

Develop an Analytics Structure
Transportation Management Systems (TMS)
BI Structure
Supply chain maturity
Architecture

Analytics Readiness
Training
Data Driven
Organizational Commitment
Visualization Techniques
Data Driven Decision-Making
Current and Future Trends

Know Your Metrics
Metrics and Strategy
Understand the organization
Available data
Supply Chain Nexus

Understanding Your Partners
Collaboration among partners
Organizational flexibility and culture
Cultural Sensitivity

Analytics to Create Value
Organizational Value
Industry Turbulence
Self-service Analytics

Source: Author.

- **Analytics Readiness**

  o **Training:** All organization must be ready to adopt a data driven/analytic approach to decision making. This is true for all logistics and supply chain providers from the owner-operator to the large logistics providers. Part of that preparation is Data/Analytics training, as illustrated by Beall in

Top 10 Best Practices For Next-Gen Analytics. The organization must be prepared to provide the training necessary for successful implementation of an analytics culture.

o **Data Driven:** The organization needs to be ready to collect and accept multiple data sources (e.g., enterprise systems and data flows as shown in

Figure 1, available public data, industry trend data). Many logistics and supply chain providers often operate by "gut feel." Intuition and knowledge about one's industry is important, but a change to decision-making that combines data and knowledge is a culture shift for which the organization needs to be ready.

- o **Organizational Commitment:** Incorporating analytics in to your logistics and supply chain operation requires a commitment from the highest levels within the organization. The organization must strive to be a good analytics organization.

- o **Visualization Techniques:** The organization must understand the available data and the best way to visualize it. They must also understand how appropriately visualized data can impact your business. An example of this can be seen in Figure 6, specifically in the BI layer, but all layers must work together for the optimal results.

- o **Data Driven Decision-Making:** A culture of decision-making supported by analytic technologies must be adopted. Analytics without action won't yield measurable impact. (Beall, 2014)For example, an emphasis on visualizations, dashboards, and other appropriate technologies such as of forecasting are important. These must support logistics and supply chain decision-making through IT technologies.

- o **Current and Future Trends:** A logistics and/or supply chainorganization that is ready to adopt decision-making supported by analytics must be mindful of upcoming supply chain and logistics trends from all areas (e.g., technology, social & business, etc.) so they can remain current, discussed in the section of the article"Supply Chain Analytics and the FTL Carrier."

- **Know Your Metrics**

  - o **Metrics and Strategy:** An important part of any strategy is to know your metrics. It is important to know what your strategic goals are, but it is equally important to understand your metrics and benchmarks for those metrics so you can understand if strategies are effective. Data can get stale. Models can get stale. It's important to revisit any kind of analysis where action is taking place on a periodic basis to make sure that your data is still relevant and that your model still makes sense. (Beall, 2014)This allows an organization to evaluate strategy regularly to find new opportunities, and remove outdated info/processes.

  - o **Understand the organization:** It is easy for an organization to develop a culture not conducive to looking at what might be going wrong. The culture of "it has always been done this way" can prevail instead of a culture that says we "should beon the lookout for missed opportunities." The organization should be aware of organizational and operational blind spots.

  - o **Available data:** In today's data driven society where virtually every device from electronic logging devices, the very trucks that transport cargo to the cargo itself generate data. Along with that, there are numerous public datasets available from government agencies that can be leveraged. Together the IOT

and public datasets create the big data problem. The organization must learn how to leverage these data for supply chain and logistics decision making in all areas of the organization (e.g., marketing and sales, product management, operations, new business)

o **Supply Chain Nexus:** Different organizations within the supply chain operate with varying amounts of control and will have access to different data; data will come at different velocities (rates), volumes, and varieties. (Laney, 2001)If you are an owner-operator of a fleet or single truck, a 3PL provider, and a mega-logistics and supply chain organization like FEDEX or UPS,you will need and have access to different data.Therefore, is it important to know where you are within the supply chain (e.g. owner-operator, 3/4/5Pl Provider, LTL, FTL) as this will impact the data you need to access and which analytics are important.

- **Analytics to Create Value**

  o **Organizational Value:** An organization should not begin an analytics project unless they can clearly see how that project will create value to the organization. Once that hurdle has been surmounted, analytics and its data-driven IT utilities can be used to better aide decision making, as seen in

Figure 7.

- o **Industry Turbulence:** Effective and well-planned analytics can be used to "flatten" out the business during turbulent times (e.g. avoid the bull-whip effect). An analytics project should be begun with this in mind.
- o **Self-service Analytics:** It is often temping to perform analytics from a Center of Excellence, but the analytics that best support decision-making are self-service business intelligence. Even as Rasmussen and Ulrich advocated for a center of excellence in section of the article "Learning from Practice: How HR Analytics Avoids Being a Management Fad," they acknowledged that analytics must be available on a self-service basis that allows the managers to create their own intelligence.The manager that can support their ideas with business intelligence which they create to support their needs, rather than a "stock report" they must review, is much more likely to use the BI provided to them.

- **Understanding Your Partners**

  - o **Collaboration among partners:** The n-tier supply-chain is created through many suppliers, manufacturers, logistics and supply chain organization. Effective BI is created through open collaboration and communication among those partners.As TechTarget mentioned in the section of this article "Logistics Management Systems and Best Practices," understanding customer logistics from an internal and external perspective is paramount in a best practice."
  - o **Organizational flexibility and culture:** To maximize effective BI through the supply chain, it is important for all partners to build/maintain a culture of organizational flexibility so together the partners can achieve the best outcomes. It important to understand the organization, data sources and flows within the n-tier supply chain so they can must be maximized.
  - o **Cultural Sensitivity:** Globalization of supply chains has necessitated that partners understand how each interpret data. Understand whereanalytics will be used and the various cultural implications of data visualization. All organizations should know their culture and strive for the partner level in the model of cultural sensitivity (see Figure 10).

- **Develop an Analytics Structure**

  - o **Transportation Management Systems (TMS):** There are many transportation management systems available both commercially and built within the organization. These systems manage the information flows and mirror the impact of revenue management systems. Each partner in the n-tier supply chain must have access to the BI created through these systems.
  - o **BI Structure:** All organization should develop an analytics structure (like the revenue analytics process and architecture) based on your organization culture, and needs. Not all organization have the same needs, but the can

all share information across the supply chain to maximize efficacy (e.g. Figure 6).

- o **Supply chain maturity:** To understand how well your organization uses its data to create BI they should implement a tool like the supply chain analytics maturity model (Figure 2) and measure often.
- o **Architecture:**Once an understanding of the data sources and flows, public data, and IOT data is created, it is important that the organization has a system architecture that matches the overall goals of the organization (e.g. Figure 6)

Future Work

Initially, the following work will be used to test our model:

- A convince sample of existing mailing lists and LinkedIn groups wil be used to obtain information from FTL organization including LTL, FTL, Owner-operators, spot and 3/4/5 PL providers
  - o They will be sent a survey of built around the above framework. This survey will be factored so we can ensure it represents what industry believes. This factoring process will validate our categories and individual items.
- The factor analysis will be compared to our FTL model and the model will be adjusted as necessary. A new model will be built.
- The new model will be tested with ??WATSON? and further contextual analysis will be done.
- Create a maturity model that allows logistics providers to understand where they are along the dimension of the model and how they can get to a higher level.

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