Architecture of Information Systems - Milestone 1
Digital Transformation in Supply Chain: Towards Cloud-Based Transport Management

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1 Analysis of the company

After carefully examining the D8L organization, we performed a SWOT analysis that is presented in Figure 1. In the following lines, we summarize the main strengths, weaknesses, opportunities, and threats identified while studying the company.

Strengths

The organization has many long-term contracts, skilled employees, established processes, and a lot of experience in the market. The IT landscape is simple, the organization uses software based on well-known processes, and the data is stored safely.

Weaknesses

When it comes to weaknesses, there are many more compared to strengths, leaving a lot of space for improvement. D8L lacks infrastructure like temperature-controlled trucks and warehouses which makes them lose a lot of money. The biggest issue is related to automation because almost all procedures are manual or semi-automated, leading to slow and unpleasant processes. The decisions are made manually based on employees' experience and the company lacks predictive tools that would give them a competitive advantage and let them avoid the need to manually handle disruptions. However, the planners are accustomed to current practices and impose resistance to change. Moreover, the IT systems are not linked and their interfaces with clients are heterogeneous and hard to maintain or integrate with external systems.

Opportunities

First, the biggest opportunity is the recognition of the need to invest in digital transformation and predictive technology. Secondly, we believe D8L can benefit by leveraging the requirements of clients to transport perishable goods and the option to contract other transport companies. Hence, the organization can grow this side of the business. By having an almost rudimentary IT landscape, digital transformation can be implemented more easily, without the need to adapt many complex IT systems. Also, investments to meet the carbon emission goals would enable the company to increase margins. Last but not least, the ambitions of the new CEO to make D8L a 4PL leader increase budgets to accelerate technological development and become more profitable.

Threats

Old practices and lack of investments in new technologies together with the development of new logistic service providers (LSP) make D8L susceptible to the loss of their clients. 4PL competitors have better prices and services due to their predictive approach to transport. D8L does not know in advance if there are going to be issues with a route, leading to a loss of trust especially from their small clients that receive a standard assurance of timely delivery. Considering these issues, D8L is seriously under the threat of competitors.

2 Identified directions of change

Changes in the needs and demands of stakeholders

D8L is operating in an evolving landscape where the demands of clients are constantly evolving and they need to adapt to meet these to keep their footing in the market, the most prevalent of these demands is the need for **Real-Time Status Updates and Transparency**, clients now want real-time data about their shipment conditions and updates on disruptions. The availability of advanced technologies amongst LSPs has further expedited this need.

Sustainable Development Goals: The European Union's sustainable development goals for 2030 emphasize reducing the carbon footprint and environmental pollution. Governments are also offering tax incentives to companies that adopt sustainable transport modes which adds weight to the use of rail and barge over road transport. This paired with clients increasingly demanding flexible transport solutions to pick from with options to track the emissions produced from them makes it important for LSPs to undertake initiatives and make structural changes to **support sustainable operations.**

Efficiency and Productivity: It is key for D8L to improve efficiency and productivity through a digital transformation which will require adopting new technologies **for efficient route planning, better disruption management, and the use of AI-driven data analytics** to be able to predict demand and optimize operations. This will require updates to PLAN-IT to transition from the significant manual input from employees. This also extends to the ORDER-IN application which increases the risk of errors and causes delays in processing orders due to manual data entry. Advanced route planning tools will also reduce the revenue loss and added carbon emission contributed by empty return journeys.

Addressing these evolving demands will support D8L's strategic goals of enhancing client satisfaction, complying with sustainability standards, and improving operational efficiency and also help their transition to a leading 4PL.

Changes in the organizational structure and process

The company's current structure can be seen in Figure 2, together with the proposed changes that will make the development of the new systems smoother and faster.
The new **Transport Management System** (TMS) will automatize the planning process, thus, we can reduce the number of planners. In addition, the IT department needs to be expanded to develop these two systems. Based on its current structure we might require new QAs and developers. The Chief Planner or Ryan can be a product owner during the TMS development. Jan, the employee who focuses on disruption reporting and management, will not be needed or his work will be significantly reduced due to the new planning system.

The new **Environmental Management System** requires a product owner who knows the environmental responsibilities and the existing European environmental rules. We might need to hire a new person for this role, based on the current team experience.

Changes in the application support

Several changes in application support can be implemented at the organization to enhance a specific goal of improving operational efficiency and responsiveness. Upgrading the Transport Management System (TMS) will automate manual processes and optimize route planning, directly reducing operational bottlenecks and improving time management. Introducing an Environmental Management System (EMS) and implementing real-time data integration will provide up-to-the-minute information on traffic, weather, and port delays, significantly reducing waiting time at ports and thus speeding up deliveries. Automating the PLAN-IT system with predictive analytics and real-time data will reduce human dependency, allowing for more dynamic and efficient route management. An interactive customer portal would enhance transparency and boost customer satisfaction by providing live data relevant to client shipments. Moreover, equipping trucks with IoT devices for data tracking and automated analysis will facilitate better maintenance scheduling and fleet management. Lastly, integrating a bidding system for transport routes will streamline operations and optimize logistics efficiency. Each of these changes will require robust technological support, in-

cluding advanced data integration capabilities, enhanced security measures, and reliable real-time communication infrastructures to ensure seamless functionality and data protection.

Changes in IT infrastructure

Given the challenges and goals of D8L, some potential changes in technology support that could improve the organization:

Advanced Analytics and Machine Learning: Advanced analytics can provide helpful information into patterns and trends in the logistics industry, helping D8L make informed decisions. Machine learning models can predict future trends based on historical data, enabling better decision-making. For example, ML algorithms can predict demand peaks, helping D8L optimize its resources. Similarly, these algorithms can predict optimal negotiable prices for orders, helping D8L maximize its profits.

Real-Time Data Integration: Real-time data integration can help D8L optimize its operations. By using real-time data such as traffic, congestion, and expected weather conditions in the TMS, D8L can optimize route planning and reduce port waiting times. This can lead to significant cost savings and improved customer satisfaction.

Automation of Order Entry: Automating the order entry process can reduce manual work and improve efficiency. This could involve developing an API for clients to enter orders into the ORDER-IN system directly. This would remove the need for manual data entry, reducing the risk of errors and improving the speed of order processing.

Secure Data Exchange: Secure data exchange is very important in the logistics industry, as sensitive information such as details of shipment and tracking data needs to be shared between different stakeholders. Using things such as IDS for secure and efficient data exchange can enhance collaboration across borders and improve the overall performance of the TMS.

Warehouse Management System (WMS): If D8L decides to have its warehouses, implementing a WMS can help manage warehouse operations more properly. A WMS can help D8L track inventory levels and stock locations, streamline picking and packing processes, and optimize warehouse space. Using the WMS with the TMS can enable smooth planning and re-planning of orders, improving overall operational efficiency.

These changes can help the business grow in terms of IT by improving data accuracy, enhancing operational efficiency, reducing manual work, and providing more flexibility in planning and executing orders.

3 Baseline architecture

Motivation Viewpoint

This viewpoint shown in Figure 3 is built based on the SWOT analysis, revealing the company's main drivers such as the market share, profits, government regulations, competition, customer requirements, and tedious manual processes. Each driver has attached an assessment based on the provided case description and the SWOT analysis, leading to more clarity of the motivation. These assessments reveal the type of the driver. For example, the lower price of other LSPs is a threat and lack of real market share increase is a weakness. Some more complex drivers are further detailed, like government regulations that aggregate the Sustainable Development Goals and the Digital Product Passport.

The CEO, customers, and employees represent the main stakeholders. Through these drivers, they want to achieve goals and enable outcomes that are added for these drivers, showing the necessary changes that need to be made to improve D8L. Last but not least, requirements, constraints, and principles are included to detail the outcomes, ensure back-compatibility with the customers' systems, or illustrate the demands of the solutions that have to be implemented.

Organizational Viewpoint

We identified the following business roles and actors:

- **Business Actors:** Dirk, Dennis, Susan Arthur, Truck Driver, Sandra, Cristina, Ryan, Jan, IT member, Strategic Decisions Board, IT Department, Finance Department, Front Desk, and Planning Department.

- **Business Roles:** Active Mentor, CEO, CFO, Chief Planner, HR Head, Finance Head, Secretary, Contract/Permanent Driver, Front-Desk Manager, IT Manager, Planner Assistant, and Disruption Manager.

  They can be seen together with their relationships in Figure 4.

Product Viewpoint

Figure 5 illustrates the product viewpoint of the business. It shows the values the product will offer stakeholders, types of contracts, business services, and business actors involved. In the case of D8L, logistics is the product they offer, available through two types of contracts: long-term and one-off contracts. The product offers values such as efficient and reliable transport of goods and quick and dependable delivery of parcels. It involves three business actors and offers three types of services to clients: road and transport, waterway cargo, and courier services.

Information Viewpoint

The diagram 6 outlines relationships and data flows between entities such as Customers, Invoices, Contracts, and Purchase orders. It provides a foundational view for identifying critical data pathways and dependencies that can be leveraged or optimized in the "to-be" architecture. This model serves as a basis for future enhancements, focusing on streamlining data integration and improving operational efficiencies in the next phase of architectural development.

Service Realization Viewpoint

The figure 7 shows the Service Realization Viewpoint which provides a depiction of D8L's operational framework. It highlights how different actors, processes, and services are integrated to support the company's logistics and transport management. The business processes are supported by relevant application services. D8L's key operational flow of order processing, route planning, customer service, fleet and financial management and related supporting services of their current structure are also depicted. The key employees that form the backbone of these services have been portrayed in their relevant roles.
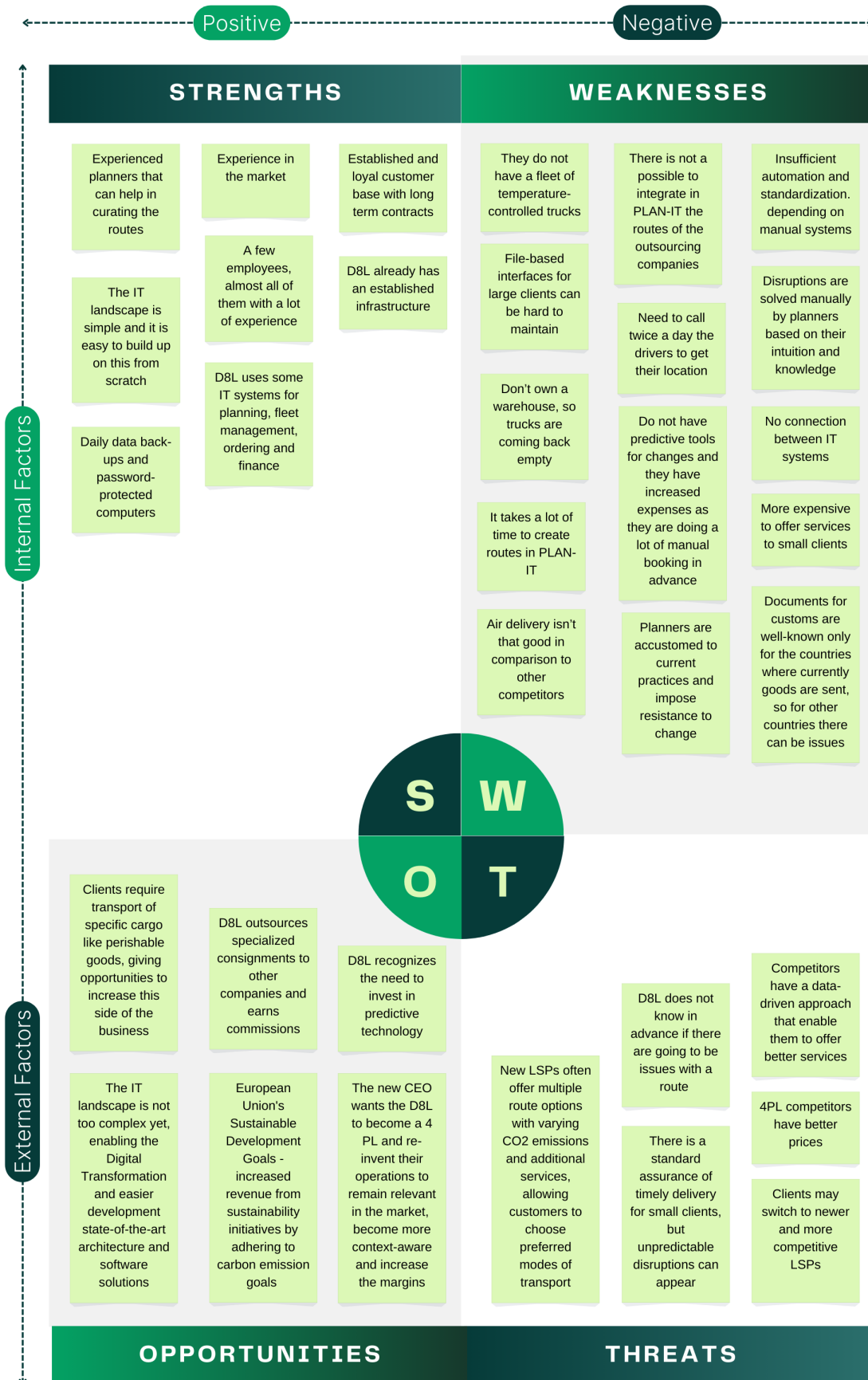
Appendix

Figure 1: SWOT analysis

Positive — **Negative**

Internal Factors

STRENGTHS

- Experienced planners that can help in curating the routes
- The IT landscape is simple and it is easy to build up on this from scratch
- Daily data back-ups and password-protected computers
- Experience in the market
- A few employees, almost all of them with a lot of experience
- D8L uses some IT systems for planning, fleet management, ordering and finance
- Established and loyal customer base with long term contracts
- D8L already has an established infrastructure

WEAKNESSES

- They do not have a fleet of temperature-controlled trucks
- File-based interfaces for large clients can be hard to maintain
- Don't own a warehouse, so trucks are coming back empty
- It takes a lot of time to create routes in PLAN-IT
- Air delivery isn't that good in comparison to other competitors
- There is not a possible to integrate in PLAN-IT the routes of the outsourcing companies
- Need to call twice a day the drivers to get their location
- Do not have predictive tools for changes and they have increased expenses as they are doing a lot of manual booking in advance
- Planners are accustomed to current practices and impose resistance to change
- Insufficient automation and standardization. depending on manual systems
- Disruptions are solved manually by planners based on their intuition and knowledge
- No connection between IT systems
- More expensive to offer services to small clients
- Documents for customs are well-known only for the countries where currently goods are sent, so for other countries there can be issues

External Factors

OPPORTUNITIES

- Clients require transport of specific cargo like perishable goods, giving opportunities to increase this side of the business
- The IT landscape is not too complex yet, enabling the Digital Transformation and easier development state-of-the-art architecture and software solutions
- D8L outsources specialized consignments to other companies and earns commissions
- European Union's Sustainable Development Goals - increased revenue from sustainability initiatives by adhering to carbon emission goals
- D8L recognizes the need to invest in predictive technology
- The new CEO wants the D8L to become a 4 PL and re-invent their operations to remain relevant in the market, become more context-aware and increase the margins

THREATS

- New LSPs often offer multiple route options with varying CO2 emissions and additional services, allowing customers to choose preferred modes of transport
- D8L does not know in advance if there are going to be issues with a route
- There is a standard assurance of timely delivery for small clients, but unpredictable disruptions can appear
- Competitors have a data-driven approach that enable them to offer better services
- 4PL competitors have better prices
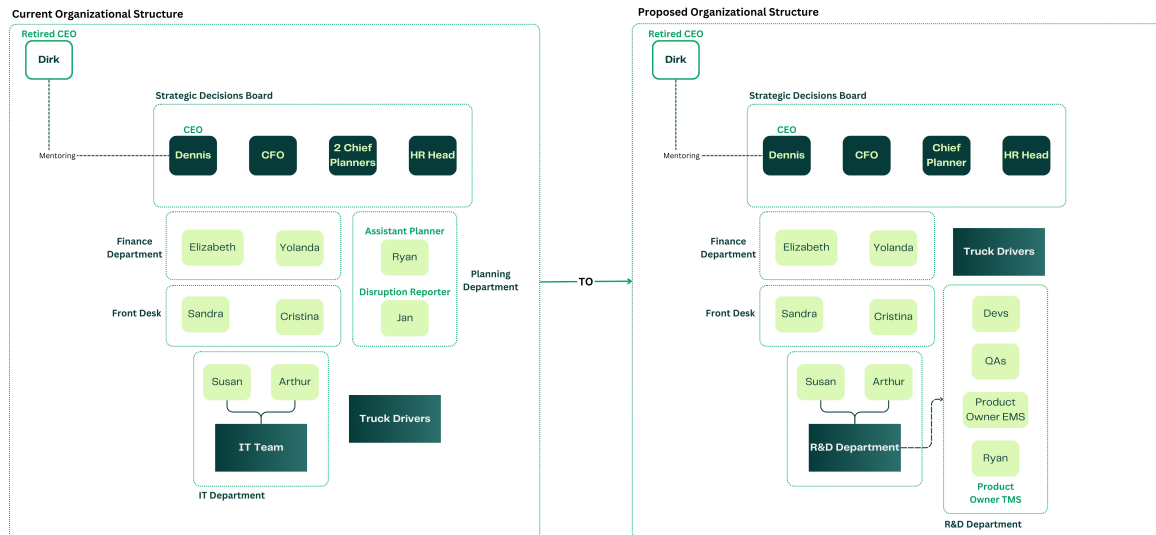- Clients may switch to newer and more competitive LSPs
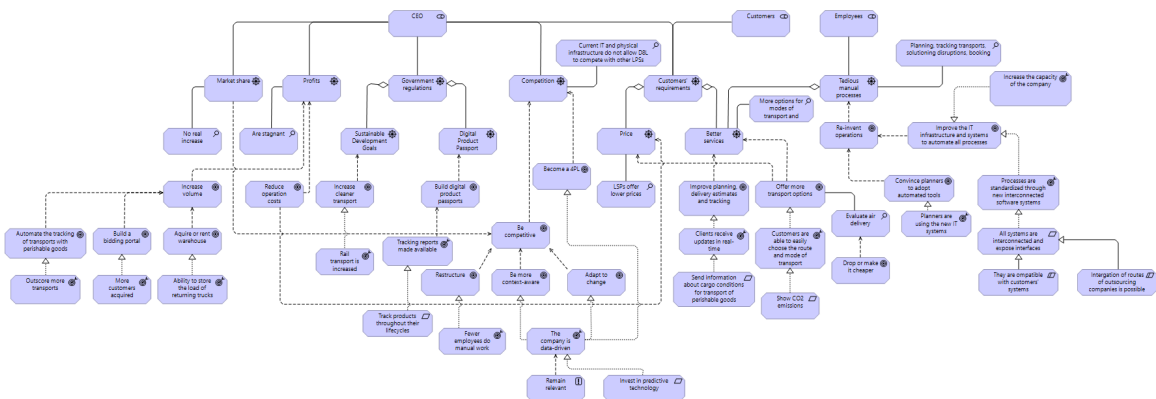
Figure 2: Current Organizational Structure

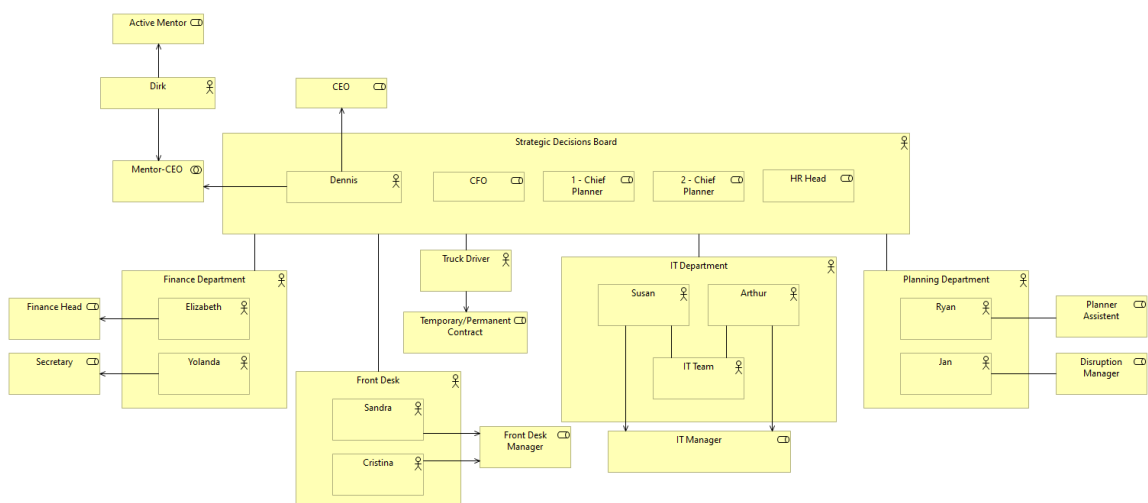Figure 3: Motivation Viewpoint

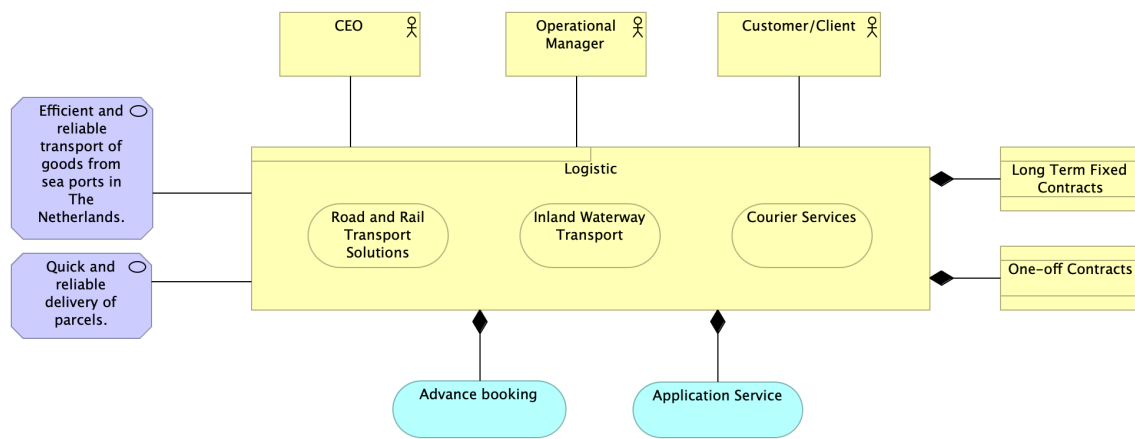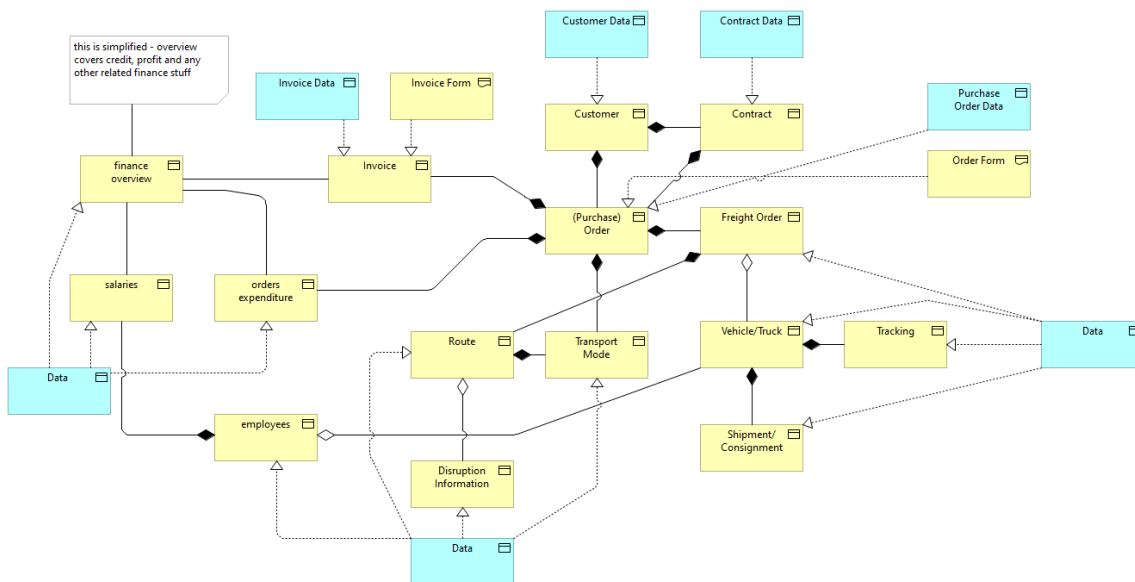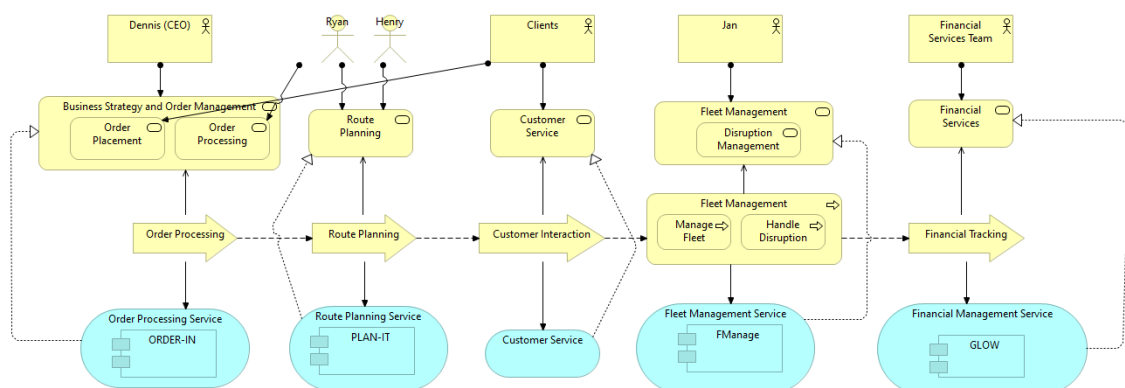Figure 4: Organizational Viewpoint

Figure 5: Product Viewpoint

Figure 6: Information Viewpoint

Figure 7: Service Realization Viewpoint