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BACHELOR THESIS

(EXPLANATORY NOTES)

OF GRADUATE OF ACADEMIC DEGREE

«BACHELOR»

THEME: ***«Software design for a logistics company»***

Speciality 073 «Management»

Educational and Professional Program «Logistics»

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ДИПЛОМНА РОБОТА

(ПОЯСНЮВАЛЬНА ЗАПИСКА)

ВИПУСКНИКА ОСВІТНЬОГО СТУПЕНЯ

«БАКАЛАВР»

ТЕМА: «***Проєктування інформаційного забезпечення діяльності логістичної компанії***»

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NATIONAL AVIATION UNIVERSITY
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Academic degree Bachelor

Speciality 073 «Management»

Educational and Professional Program «Logistics»

APPROVED
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TASK

FOR COMPLETION THE BACHELOR THESIS OF STUDENT

Tymofii A. Zubar
(surname and name)

1. Theme of the bachelor thesis: «Software design for a logistics company» was approved by the Rector Directive №679/ст. of April 28, 2021.
2. Term performance of thesis: from May 17, 2021 to June 06, 2021 and from June 14, 2021 to June 20, 2021.
3. Date of submission work to graduation department: June 04, 2021.
4. Initial data required for writing the thesis: general and statistical information about global logistics software market, information and production indicators of the company «MyFish», financial indicators of the «MyFish» projects, project, literary and Internet sources.
5. Content of the explanatory notes: introduction, the concept of logistics management; the specifics of logistics software industry; the essence of project management tools; Analysis of the global logistics software market; Characteristic of global logistics software economy; Characteristic of MyFish; Project description; Implementation of project management tools to the creation software for logistics management of a logistics company; Economics component of the organization software design for a logistics company; conclusions and appendix.
6. List of obligatory graphic matters: charts, diagrams, graphs, tables illustrating the current state of problems and methods of their solution.

7. Calendar schedule:

№	Assignment	Deadline for completion	Mark on completion
1	2	3	4
1.	Study and analysis of scientific articles, literary sources, normative legal documents, preparation of the first version of the introduction and the theoretical chapter	17.05.21-20.05.21	Done
2.	Collection of statistical data, timing, detection of weaknesses, preparation of the first version of the analytical chapter	21.05.21-24.05.21	Done
3.	Development of project proposals and their organizational and economic substantiation, preparation of the first version of the project chapter and conclusions	25.05.21-29.06.21	Done
4.	Editing the first versions and preparing the final version of the bachelor thesis, checking by standards inspector	30.05.21-01.06.21	Done
5.	Approval for a work with supervisor, getting of the report of the supervisor, getting internal and external reviews, transcript of academic record	02.06.21-03.06.21	Done
6.	Submission work to Logistics Department	04.06.21	Done

Student_____
(signature)

Supervisor of the bachelor thesis _____
(signature)

8. Consultants of difference chapters of work:

Chapter	Consultant (position, surname and name)	Date, signature	
		The task was given	The task was accepted
Chapter 1	Senior lecturer, Volovyk O.I.	17.05.21	17.05.21
Chapter 2	Senior lecturer, Volovyk O.I.	21.05.21	21.05.21
Chapter 3	Senior lecturer, Volovyk O.I.	25.05.21	25.05.21

9. Given date of the task May 17, 2021.

Supervisor of the bachelor thesis: _____ Volovyk O. I.
(signature of supervisor) (surname and name)

Task accepted for completion: _____ Zubar T.A.
(signature of graduate) (surname and name)

ABSTRACT

The explanatory notes to the bachelor thesis «Software design for a logistics company» comprises 74 pages, 28 figures, 3 tables, 2 appendices, 52 references.

KEY WORDS: SOFTWARE, INFORMATION MANAGEMENT, LOGISTICS MANAGEMENT, FISH RESTAURANT BUSINESS, LOGISTICS MANAGEMENT SOFTWARE, SOFTWARE DESIGN, DATA MANAGEMENT

The basic principles of data collection, structure, and management in the restaurant business are considered in the bachelor thesis.

The theoretical part covers the logistical management concept, restaurant business principles, and data design foundations. The analytical part is devoted to the market analysis of restaurant business in Ukraine, logistical components of the restaurant's functions, and the structure of the information flow in a logistical enterprise.

The subject of the investigation is the organization of a software design for a logistics company on an example of MyFish company.

The object of the research is the flow of information exchange in the business process, the coordination of the processes through an effective data structure, and information exchange between participants of the logistical process.

Methods of research are analysis, synthesis, induction, deduction, modeling, and generalization.

Materials of the thesis are recommended to be used in scientific research, educational process, and for experts in logistical and software development departments.

CONTENTS

NOTATIONS

API – Applied Program Interface

CI/CD – Continuous Integration / Continuous Deployment

CRM – Customer Relationship Management

DB – Database

ERP – Enterprise Resource Planning

IaaS – Infrastructure as a Service

IDE – Integrated Development Environment

ISV – Independent Software Vendor

IT – Information Technologies

LMS – Logistics Management System

PaaS – Platform as a Service

SaaS – Software as a Service

SCM – Supply Chain Management

TMS – Transportation Management System

UI – User Interface

UX – User Experience

WBS – Work Breakdown Structure

WMS – Warehouse Management System

INTRODUCTION

Logistics is one of the most rapidly growing industries throughout the world. And information technologies deserve much credit in it. Both industries became vital for everyone who produces goods or provides services because they must move them to end-user.

Here is the list of problems at any logistics enterprise, that can be easily solved with the usage of IT: refine transportations, reduce delivery time, minimize human errors, automate functions, reduce costs. In Chapter 1, each item in the list is described in detail. In Chapter 3, it is shown which of them are solved with the implementation of software on the example of "MyFish" company.

There are lots of small and medium logistics companies that use old-fashioned ways to manage their business. But these companies care about the money they earn and lose. A solution to these issues would pay a lot for each of them. Various types of software solve the problems that enlisted logistics companies have.

The implementation of IT solutions for a logistics company changes the way it works. Software is aimed to modernize the organizational structure of the company. Operations managers are continuously informed about all supplies that are being transported, stored, and ordered. It is possible to calculate the money flows, restructure and modernize warehouses, keep contact with customers and suppliers. With continuous support from technical consultants of provided software, the enterprise can customize the program for its needs. Generally, companies that develop software as a service, provide continuous support of their application as the basic option.

The relevance of the topic is explained by the fact that in 2021 year, in such a competitive market environment, every company must invest in information technologies, exactly in the logistics industry, which digitalizes more and more. Furthermore, during the period of the global pandemic of COVID-19, it would not be possible to prevent huge expenses without restructuring logistics management. Also, the example of "MyFish" fish

restaurant shows, how fast response to changing market environment along with appropriate geographical and marketing positioning keeps the customers loyal even in the period of full lockdown.

The analytical part comprises the position of “MyFish” fish restaurant at the market, along with a description of its supply chain. Also, it is characterized, how the company transformed for ongoing market requirements over the 2020 year, how it changed the organizational structure to survive during the period of full lockdown in Spring 2020.

In the practical part, it is shown, how to streamline the process of adopting new software for a fish restaurant “MyFish”. All internal and external factors are analyzed, and the problems which are detected as important for the company are solved.

The main principle of business is to maximize the revenues while minimizing the costs which can be achieved through the adoption of existing software tools available in the IT market. The process of designing and adopting those tools is described further in this research.

Knowledge of software development, supply chain management, restaurant business peculiarities will help to produce a ready-to-use prototype of software for a logistics company, involve it in company operations, and optimize information flow within the company.

CHAPTER 1
THEORETICAL BASIS OF PROJECT MANAGEMENT IN THE LOGISTICS MANAGEMENT SOFTWARE

1.1 The logistics management in the restaurant business

Logistics is a term that can be explained differently. Everybody who takes part in the process of moving goods or services from the point of origin to the point of consumption has his view on logistics management.

According to Heizer's, Render's, and Chuck's book "Operations Management", logistics management can be defined as "an approach that achieves operations efficiency through the integration of all material acquisition, movement and storage activities" [8]. Numerous authors have characterized logistics management differently. The closest one is the author of the Council of Logistics Management, the main association for logistics experts with a current enrollment of more than 15,000 people. It characterizes the term of logistics management as a piece of the supply chain that that plans, carries out, and controls the productive, effective flow and storage of goods and services, and related data from the point of origin to the point of consumption to meet customers' needs and requirements [51]. Generally, logistics means activities that occur inside an enterprise, though the supply chain implies interconnected stakeholders that work efficiently with the enterprise to move a product to a target market [24]. expressed that logistics management activities ordinarily incorporate inbound and outbound transportation management, warehousing, materials handling, fleet management, inventory management, order fulfillment, supply/demand forecasting, and management of third-party logistics providers. All in all, sourcing and procurement, production scheduling and planning, packaging, wrapping and assembling, customer support are also included in the logistical

functions. Logistics incorporate five interrelated activities: inventory management, supply, transportation, warehousing, and customer service [25]. Besides, logistics allude to the system of design that is utilized to control changing location of raw materials, work-in-process, and finished goods at the cost-effective point [23].

Coyle, Langley, Novack, and Gibson gave a short definition that logistics is tied in with getting the right product, in the right quantity, in the right condition, at the right place, at the right time, at the right cost, and to the right customer [26]. Conclusively, Schönsleben presumed that logistics management identifies with the effectiveness and efficiency of the enterprise's management [27].

It accompanies day-by-day movement in assembling the organization's finished goods and services. Numerous authors characterize various logistics activities from the viewpoint of the restaurant business. Dani referenced that the food supply chain is the cycle processes that help with delivering the food from its raw material to the customer plate [28]. Dealing with a restaurant offers great challenges. One of the fundamental procedures in restaurant management is how to control the inventory of a restaurant. Experienced managers have discovered that it is important to have many approaches and methods set up as something is always going to come up to demand their consideration. Restaurants that work with a less margin always watch out for cost control. After labor remuneration, food costs are typically the biggest expenses for restaurants. Thus, most restaurants have relatively strict inventory control policies. At long last, it is acknowledged that logistics is like eating at a café. It is the movement of material, data, and money among suppliers and customers [25].

For successful logistics management, it is important to measure service quality. To do this, there are different researches available at the market. One of them is SERVQUAL. It is a multidimensional research instrument designed to measure service quality by capturing respondents’ expectations and perceptions along five dimensions of service quality, such as reliability, assurance, tangibles, empathy, and responsiveness [52].

1.2 The specifics of software in the logistics industry

Information technologies are widely used throughout all industries nowadays. In logistics, it is a vital competitive advantage. The first stage of involving information technologies in the operations of a logistical company is setting up appropriate software for each process.

Before settling on software for logistics management, it is vital to understand the requirements and challenges a business faces daily. Carrying out a detailed analysis can help identify deficiencies in the existing logistical operations of a business. Besides that, it can suggest measures to redeem any discovered shortcomings in the cycle.

When deciding on logistics management software, there are several essential factors to consider. Firstly, it should contain a basic set of functions that can aid in simple logistical management operations. Besides that, numerous other things should also be present in the software to tackle the wide base of a business's logistical operations and processes.

Logistics Management Software (LMS) simplifies logistics operations by refining the production cycle and making it easier to access important information quickly. A logistics management software helps businesses manage the various processes that go into the production cycle from the delivery of raw materials to shipping the finished products to the consumers.

Logistics software has become broader in its scope and functionality to deal with a vast array of operations and processes. A logistics management software gets rid of all the conventional approaches like paperwork and spreadsheets to simplify management. It comes in three variations: enterprise resource planning systems, warehouse management systems, and transport management systems.

Companies with an in-house logistics or supply chain division and third-party logistics providers utilize any of these different versions according to their requirements

to efficiently manage their logistical and supply chain operations. In logistics, handing over the process to logistics management software has several advantages. With logistics management software, a company or 3PL (third-party logistics) provider could avail of the following benefits depicted in Figure 1.1.

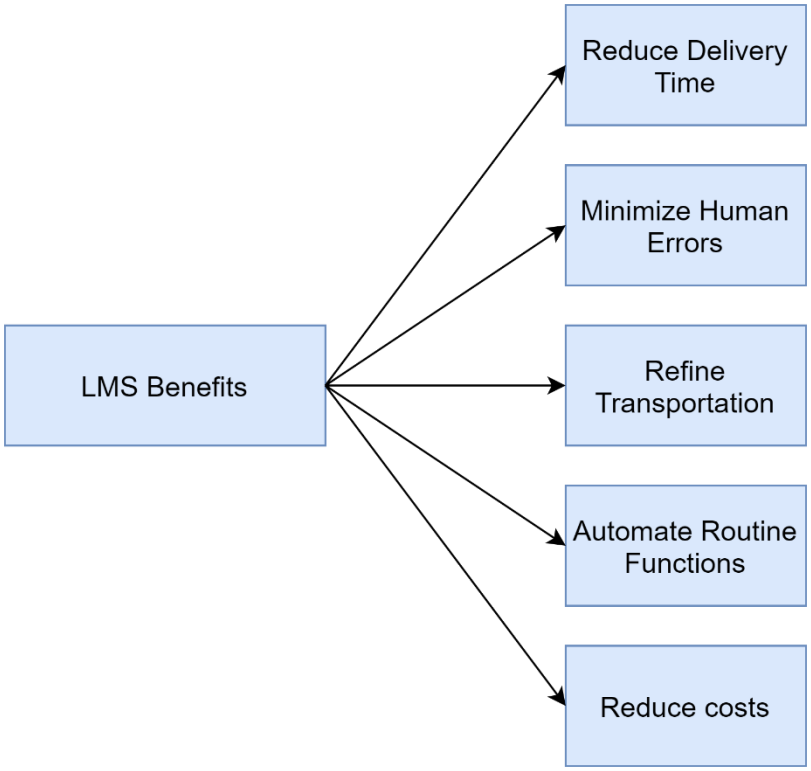

Figure 1.1 – LMS Benefits

The benefits above include reduce delivery time, minimize human errors, refine transportation, automate functions, reduce costs. The analysis of each point is introduced below and characterizes every problem by the corresponding benefit.

- Reduce Delivery Time: the logistics and supply chain industry face several issues that influence the delivery and lead to delays. By incorporating logistics software, organizations can quickly deliver their products to customers. A logistics management software can improve conveyance speed by making significant interventions in the

production cycle and picking the appropriate carrier. It eventually reduces transporting delays hugely.

- Minimize Human Errors: another prominent benefit of having logistics management software is in reducing human error. Manual analysis of a vast amount of transportation data is difficult, time-consuming, and prone to errors. A logistics software can process this information without any mistakes in less time, consistently pushing forward the operations with minimal delays.
- Refine Transportation: transportation is a crucial area of logistics. It incurs the most charges in the form of fuel, energy, labor, motorway tolls, and shipping fees. Relying on logistics software can help deal with the different transportation means and influence the operational data for process automation. Logistics management software makes it simple to analyze data and make relevant decisions for reducing costs maximizing efficiency.
- Automates Functions: process automation is a huge aid of logistics software integration. Certain functions like creating shipment routes, load planning, and tendering of load to carriers are easily automated and managed by utilizing logistics software. Furthermore, it eliminates paperwork, which helps deal with the processes efficiently and timely.
- Reduce Costs: logistics software can automatically compare various shipping services, delivery agents, and transportation methods to find the least pricing ones. The alternative way logistics software reduces costs is by bringing down the expedited shipments through improved shipment planning and forecasting [11] [34].

As for the problems mentioned in each point description, all of them have significant meaning to any logistical system. Logistics management software guarantees more efficiency and control over the logistical and supply chain operations of a business. It means simply substituting the existing manual methods with a software-centric solution. By integrating an LMS into their operations, companies could reduce their turnaround times and streamline the overall cycle of planning and delivery while keeping up with the customers' requirements.

Having analyzed the software packages available for logistical companies, the following most popular software types have been detected: ERP, WMS, TMS.
While analyzing different types of logistical management software the classification described in Figure 1.1 was developed.

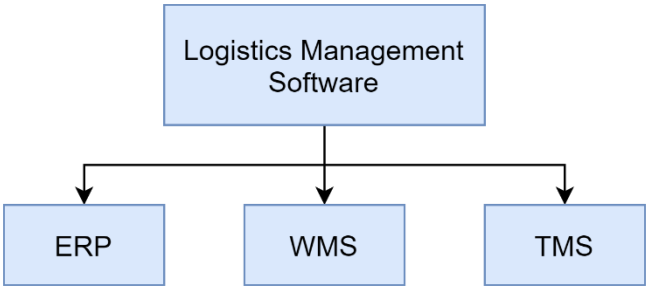

Figure 1.2 – Logistics management software types

ERP – an acronym that stands for enterprise resource planning. Enterprise resource planning software helps to integrate all the processes of a company into a single system. It can integrate planning, inventory control, sales, marketing, finance, human resources, etc [33]. Paul Myerson in his book “Lean Supply Chain Logistics and Logistics Management” mentions that several logistics management systems, which include ERP along with the creation of the Internet and e-commerce helped to improve planning and management efficiency. These technologies have also led to mass customization [10]. ERP software involves all departments and resources of the enterprise. Logistics management systems are designed to automate the flow of information, material, and financial resources of these processes to single storage, which can be accessed to get the enterprise data whenever it is needed [13], [14]. The rationale for adopting an ERP system is that the enterprise can enhance its business performance, financial predictability, productivity, and decision making by business process automation with timely access to management information [12], [15]. Adopting an ERP system is a challenging and expensive project for a company, which usually chooses an ERP product from one or

several vendors and either re-engineers its business processes to match those offered by the ERP product, or customizes the ERP product to match the existing processes [13].

ERP plays a vital role in Supply Chain Management as there is a need to interact with numerous suppliers. This in turn causes ERP vendors to concentrate more on solutions for supply chain integration. ERP System has various functional modules that help in various business functions. The most important function of ERP is Integration. It integrates data and processes from all functions of an organization.

The supply chain consists of suppliers, manufacturers, distributors, retailers, and customers. It aims to match supply and demand, profitably for products and services. SCM involves planning, execution, control, and monitoring of supply activities. The purpose of supply chain management is to improve trust and collaboration among supply chain partners. The integrated value creation process must be managed from material procurement to end-customer product delivery, and this can be easily achieved through ERP.

ERP can also be executed for corporate functions like human resources, finance, and accounting. ERP allows easy access to reliable integrated information, whereas its biggest disadvantage is its integration. Integration of ERP into the whole system is important as the system can yield long-term benefits, else it compromises the activity of the whole organization due to poor understanding of the system. In short, ERP is a system that helps commercial areas like finance, logistics, sales, production, distribution, and others that are interrelated to each other [16].

WMS – an acronym that stands for a warehouse management system. It is a software designed to support and optimize warehouse distribution center management.
This type of logistics management software is responsible for the improving efficiency of warehouse functions, storage areas, and distribution systems. It involves the various tools for operational and optimization strategies based on the system operations.

Generally, WMS software is used only for managing the warehouse, so it cannot be applied as one single solution for all enterprise operations. The WMS receives orders from

the overlying host system, mostly an ERP system, manages these in a database, and, after appropriate optimization, supplies them to the connected conveyor systems at a warehouse [41].

While ERP systems are being moved to Cloud over the recent years, WMS is being, too. When the software is based in Cloud services, it significantly increases the flexibility of using it. It can be easily accessed from any device, including smartphones. So, the implementation of different types of software to an enterprise became much easier.

The basic warehouse management flow includes the following processes: receiving, putaway, picking, packing, shipping, and return (if needed). The nature of how these processes move is described in more detail in Figure 1.2.

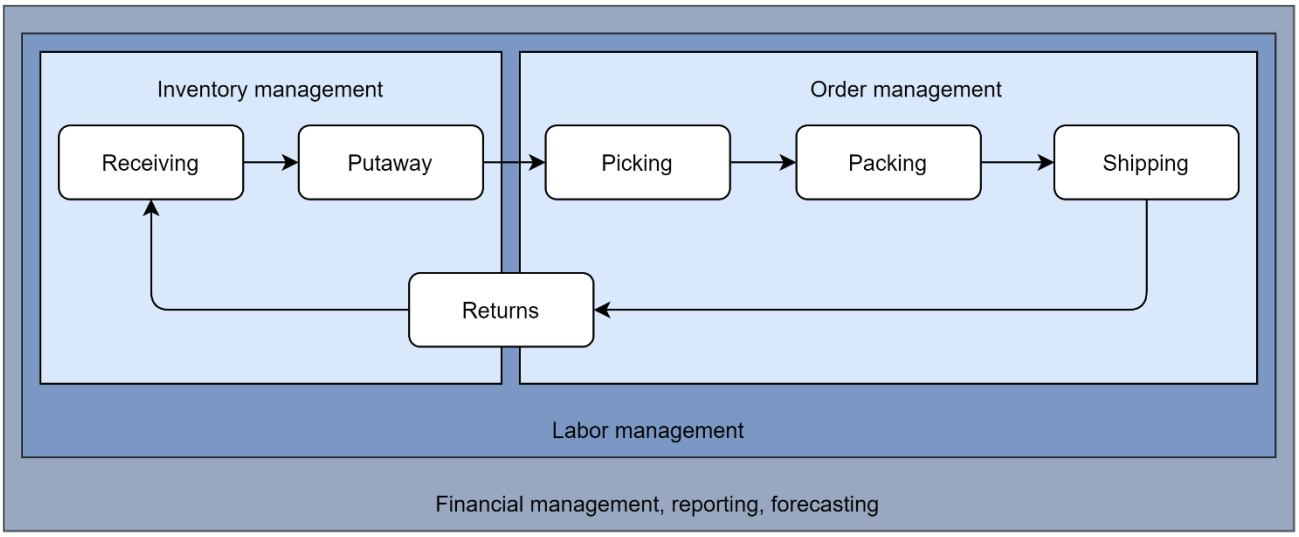

Figure 1.3 – Warehouse processes flow

After an enterprise starts to utilize WMS software, each of the processes enumerated above has room to be improved. Here are the detailed peculiarities of each of them:

- Receiving is the initial delivery handling process. It comprises such steps as placing a purchase order, preparing a space in the warehouse, unloading a vehicle, verifying received goods, adding a received item to the database. This process can be improved with WMS software features, which allow to plan the volume of goods being transported. This will provide an opportunity to prepare appropriate space in the warehouse, quantity of

workers, who will receive the goods, appropriate vehicles in the warehouse to handle the delivery. With these details ready, an enterprise can significantly reduce idle time, then cut down costs.

- Putaway is the process of movement received goods to the fitting place in the warehouse. The correct identification of each stock-keeping unit and getting it the most relevant spot is important in the putaway process. To streamline the space management at a warehouse, it is important to add all necessary information about the product in the WMS. Usually, warehouse management software offers an opportunity to separate stored products by their type. It reduces the goods damage from wrong storage and reduces time to find the corresponding item.

- Picking is the process of retrieving products from a storage facility at a customer's request. This process is regarded as the most expensive, time-consuming, and error-prone. Mobile scanning equipment and voice recognition systems can save a lot of time and considerably minimize mistakes for this kind of process. Also, to optimize a picking process, such picking methodologies as zone picking, cluster picking, wave picking may be adopted.

- Packing is the process of composing the ordered items together, ensuring their quality, and getting the product ready for shipment. It is necessary to have all required information for the order, exactly how goods should be packed and transported. To reduce time on packing, the automatic wrapper equipment.

- Shipping is the process of sending goods to customers and ensuring that they arrive safely and on time. To meet customer needs, efficient scheduling, labor management, and tracking systems are essential.

- Returns is the process of moving goods back from customers in case if they do not meet customer expectations, or they were damaged during any of previous processes. Managing returns and refunds is a hassle and needs specific supervision. Returns must be

appropriately recognized, processed, and handled, whether by restocking, sending them to repair, discarding, or returning them to the manufacturer [31].

TMS – an acronym that stands for the transportation management system. Transportation management software specializes in planning, executing, and optimizing the shipment of goods at a logistics company. Basically, TMS is a source of detailed data about the fleet, carriers. Furthermore, it allows users to plan, execute, optimize, and track shipments. It requires an integration with counterpart systems to get data about each shipment specifications and to send data from the tracking system of the vehicle to the transportations management department of a company [40].

A transportation management system is essential for any enterprise that has a major volume of transportation operations. The difficult and complex nature of today's logistics led to the unavailability of tracking everything without the usage of special software and information technologies in general. When the transportation processes are automated, it directs to reducing of human factor impact and multiplies the efficiency.

As well as all enterprise software systems mentioned above, TMS started as on-premises copies, but also have been deployed in the Cloud. Comparing with ERP and WMS, transportation management systems require the most mobility, so it results in obvious advantages when the app is hosted in the Cloud. All participants of the transportation process, from carriers to supply chain managers have continuous access and information updates about the position, time on the route, the fuel consumption of a vehicle, estimated arrival time, etc. These features increase the flexibility of the transportation process, more decisions can be made because more data is available in terms of the system. So, planning and optimizing the process of goods movement becomes quite simple and effective when it is well digitalized with the appropriate software.

Typically, all systems that take part in the logistics management process of a company share data with each other. Shipping orders come from ERP, WMS sends data about its operations, such as labor scheduling, yard management, goods palletization, etc. The three main supply chain management systems (ERP, WMS, TMS) have quite diverse roles in handling the orders in an enterprise. While they are integrated with a common software solution, with common data flow, the efficiency of using software for logistics management drastically increases. The full flow of interaction between these systems is illustrated in Figure 1.3.

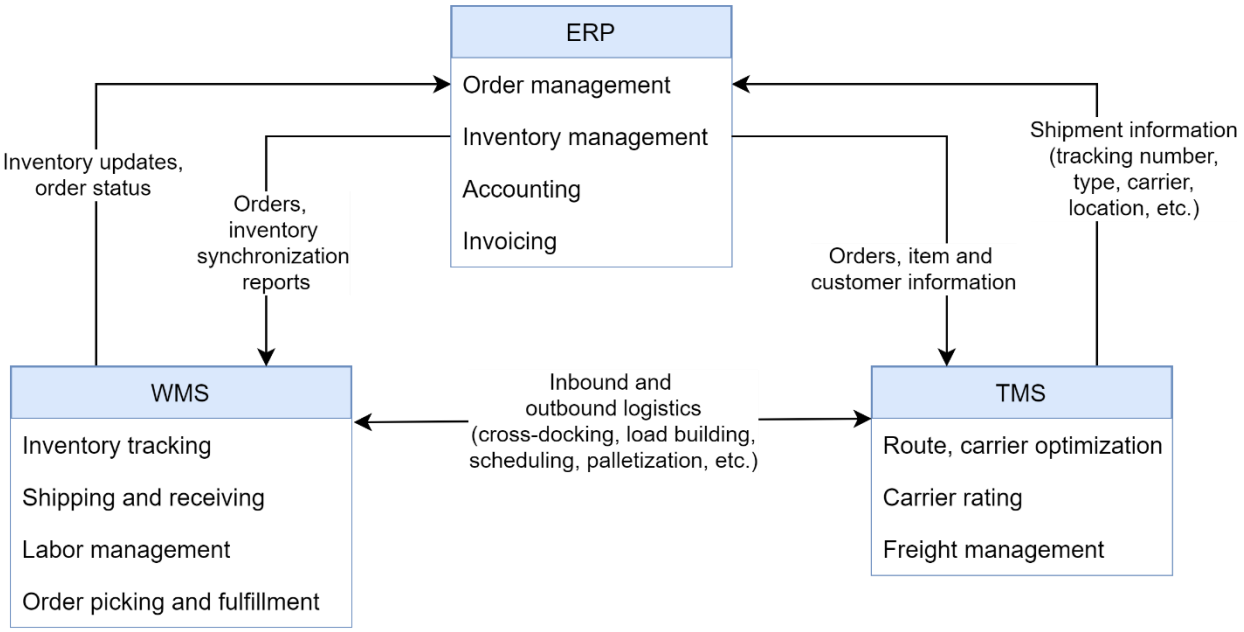

Figure 1.4 – ERP, WMS, and TMS interaction

1.3 The software development process description

Work Breakdown Structure (WBS) technique, which means breaking work into smaller tasks is a common productivity technique used to make the work more manageable and approachable. Several main points are necessary to develop a ready-to-

use logistics management software. They include the following steps: establishing product business requirements, organizing development environment, developing back-end part, developing front-end part, developing mobile version, quality assurance of an application, integration the software to an enterprise.

Initially, it is important to prepare all the requirements for the full cycle of creating software for logistics management both web and mobile applications. In this step, it is important to define customer needs and the market environment in this field.

The next step lies within the writing of user documentation. The user guide should be written by a project manager and discussed within the team to define how the application will be used and to make its usage comfortable. Terms of use are generally prepared with a lawyer.

The development team should define infrastructure requirements and a list of technologies that are the most convenient to use within the project. Along with this process, the system architect starts to organize system architecture and the most appropriate technology stack for the distinct solution.

And the last step in the first part of the work is preparing the user interface and user experience (UI/UX) layout by the designer. Product owners should define how their product should look, and then the designer implements a color palette, icons, fonts, etc. to make styles of the product unique.

When the company deals with software development, each member of the development team must be equipped with powerful hardware. Information technologies always go along with high-performance computers, devices to increase the development speed, and well-organized servers which capable to work under a big workload.

Integrated development environments are designed to maximize programmer productivity by providing tight-knit components with similar user interfaces. IDEs present a single program in which all development is done. This program typically provides many features for authoring, modifying, compiling, deploying, and debugging software.

Then, the robust internet connection should be set up, because in 2021, strong and fast network connection straightly related to the user experience from using online websites and applications. And the faster network, the bigger amount of features developers can implement, the faster they communicate with each other, so the faster the project will be broken down.

Another important factor to consider is how and where the software will be hosted. Currently, most service providers, which allow to host any websites, use Cloud solutions. From the architectural point of view, client-server systems are today most frequently implemented by (and often identified with) the request-response model: a client sends a request to the server, which performs some action and sends a response back to the client, typically with a result or acknowledgment. This often implies that it is more powerful and reliable than standard personal computers, but alternatively, large computing clusters may be composed of many relatively simple, replaceable server components.

In every website/application, all data is stored on the servers. So, the main factor of choosing the appropriate server is security and location (to reduce latency). Generally, characterizing the actual development process of an application can be simply split up into two parts – back-end and front-end.

The main objective of the back-end is to set up interaction with servers to get data and provide it in the application. Back-end developers are also responsible for the security and performance of the application. This field requires a lot of competencies because an application has to work well under high loads. Performance is also a significant factor because it is straightly related to the customer user experience of the application.

The main objective of the front-end is to provide well usage experience to the end customer. Front-end developers are responsible for application appearance and functionality on the client-side. How the website looks, animates, and being interacted with is the result of front-end developer work. They use ready data from databases, which is being provided by back-end. They should make the website look like on the UI mockup, but also connect real data to it, and make the website ready for usage.

The business data platform “Statista” mentions that: “In the first quarter of 2021, mobile devices (excluding tablets) generated 54.8 percent of global website traffic, consistently hovering around the 50 percent mark since the beginning of 2017” [39].

Regarding the citation above, it is a fact that every second person accesses the internet through a mobile phone. With such statistics, it unacceptable to develop software without mobile phone support. Usually, mobile application development starts only when the website is fully finished because the main framework for the application is the website. Mobile development becomes faster because it uses the same data that the website uses, so, back-end should not be built again from scratch. But to develop the mobile application front-end part for both Android and iOS systems natively, there are new developers needed for this purpose. To simplify this, process, various cross-platform solutions are available without the need to hire new developers on separate programming languages.

The integration step there can be included providing final specification and API for the software, pre-release quality assurance, buying storage in the cloud services for production usage, buying a web domain, and making final deployment of websites and then deploying mobile applications to App Store for iOS and Play Market for Android. Then there should be a setup environment for CI/CD of the project, and the process of further development and support of the application should be built according to the Agile and Waterfall techniques.

1.4 Human resources in software development

There are three roles in the Scrum framework. These are ideally co-located to ensure optimal communication among team members. While many organizations have other roles involved with defining and delivering the product, Scrum defines only these three: product owner, scrum master, development team.

The product owner, representing the product's stakeholders and the voice of the customers, is responsible for delivering good business results. Hence, the product owner is accountable for the product backlog and for maximizing the value that the team delivers. The product owner defines the product in customer-centric terms, typically user stories add them to the product backlog, and prioritizes them based on importance and dependencies. A scrum team should have only one product owner. Although a product owner could support more than one team. This role should not be combined with that of the scrum master. The product owner should focus on the business side of product development and spend most of their time bridging with stakeholders and the development team.

The product owner is a single point of making final decisions for the team in the project, which is why it is always one person, not a group or committee. The responsibilities of the Product Owner are as follows: ensuring the clarity of product backlog, providing business requirements to the development team, coordinating and prioritizing tasks, liaising with the customers and the team, sharing team progress on meetings with business owners of a company.

Another important role in the Scrum framework is the Scrum master. Their main task is to train the members of the team to interact with each other and with business representatives, as well as to optimize processes, increasing their efficiency.

The scrum master is not a traditional team lead or project manager but acts as a buffer between the team and any distracting influences. The scrum master ensures that the Scrum framework is followed. This person helps to ensure the team follows the agreed processes in the Scrum process, often facilitates key sessions, and encourages the team to improve.

The core responsibilities of a scrum master include helping the product owner with product backlog prioritization according to team readiness, helping the team to determine the definition of done for the product, facilitating team events to maintain regular progress, coaching the team within the Scrum principles to deliver high-quality for each product feature, etc.

One of the ways the scrum master role differs from a project manager is that the latter may have people management responsibilities and the scrum master does not. A scrum master provides a limited amount of direction since the team is expected to be empowered and self-organizing. Scrum does not formally recognize the role of project manager, as traditional command and control tendencies would cause difficulties.

The Scrum Master leads the Daily Scrum Meeting and tracks the progress of the team using the Sprint Backlog, noting the status of all tasks in the sprint. The Scrum Master can also help the Product Owner create a Backlog for the team.

The basic day for Scrum Master in a software development company is the next:

- Daily meeting of up to 15 minutes, and depending on the sprint phase, one of the longer meetings can be scheduled - sprint planning, sprint review, or sprint retrospective).
- Solving priority current issues, collect, analyze, information, plan and prepare meetings, draw up and discuss further plans.
- Working with the team, 1-on-1 meetings.

Finally, every role described above does not make sense without the development team. It consists of the following people.

- UI/UX designer – a person who provides layouts for every page and every icon within the whole application, this person provides them for every platform and maintains brand identity.
- Front End developer – people who responsible for the visual view of the website. Front-end is important as it connects two crucial areas: the website design (vision, look, feel, the personality of the site) and the back-end development (the working pieces, content, management areas, and dynamically driven data of the site)
- Back End developers – people who are primarily focused on how a website works. They write code that focuses on the functionality and logic powering the application they’re working on, and the technology they work on is never directly seen by users.

- Quality Assurance engineer – people who are responsible for the product quality. They prevent application failures through continuous testing and issue reporting. They work in close cooperation with developers.
- System Architect – a person who sets up the full architecture of a system, improves performance, continuously integrates and deploys the system, keeps it working permanently.
- Team Lead – a person who sets up and keeps control of the development team. This person organizes the working process according to agile methodologies, assigns tasks to every employee in the development team.

1.5 Conclusions to Chapter 1

During the research of the existing sources and approaches to such concepts as logistics system, restaurant business, informational flow within the logistics system, the following bottlenecks in these processes were identified: long delivery time, the big impact of human errors, improper transportation system structure, unoptimized routine functions, overhead costs.

The core methodology which solves the majority of described problems is the optimization of information flow within the logistical system. To implement this methodology, a lot of tools are available in the logistics management software market.

MyFish is a restaurant, and it is a part of the hospitality industry, so a lot of attention should be paid to service quality because it receives the main revenue from its customers. According to the given theoretical information about the measurement of quality service, the SERVQUAL methodology is explained, and the MyFish enterprise should consider paying attention to such SERVQUAL dimensions as assurance and responsiveness. Assurance is the knowledge and courtesy of employees and their ability to convey trust

and confidence. Responsiveness is the willingness to help customers and to provide prompt service.

With the implementation of logistics management software, assurance can be achieved with strict standardization of data structure and user interface. It is quite common, when personnel who works with software for order management at a restaurant, have a wide range of possible inputs to the program, which leads to a variety of errors in the functionality of an application.

While working with customers at a restaurant, responsiveness to their requests becomes significant for attracting them for further visits. In the case of providing responsiveness into the developed software for managing a restaurant as a logistical system, the user interface inputs must be limited to prompts with single-select options instead of string inputs to reduce possible typos.

CHAPTER 2
MARKET ANALYSIS OF LOGISTICS-RELATED SOFTWARE

2.1 Analysis of the Ukrainian logistics management software market

IT industry in Ukraine has significantly evolved over the years [3]. In 2021, the majority of companies that provide software to large enterprises for managing their business, switch to Cloud computing [29]. Cloud computing is typically defined as a type of computing that relies on computing resources rather than having local servers. The hardware (servers, storage, network) for running any program is placed in a special facility and provides its computing power over the internet connection directly to the customers.

With cloud computing gaining momentum in 2021, a whole new way of processing data is unveiled. The tech innovations in 2021 have influenced supply chain and logistics operations. Increased adoption of supply chain and logistics solutions in 2021 will lead to a shift from the on-premise model to the SaaS model.

Predictions estimate that a subscription-based SaaS model will dominate supply chain management in 2021 and beyond. Adopting a cloud-based supply chain solution offers benefits in the form of flexibility, robustness, and affordability. Free and open-source software adoption has made the Cloud the primary choice for logistics providers and organizations worldwide.

Cloud-based SaaS supply chain solutions offer numerous benefits. It gives a comprehensive outlook on the overall operations in logistics by making processes more transparent and collaborative. Implementing a cloud system reduces the upfront and operating costs. It also offers the ability to scale up with the business needs and enhances supply chain efficiency [32].

Generally, cloud-based software is divided into the categories depicted in Figure 2.1:

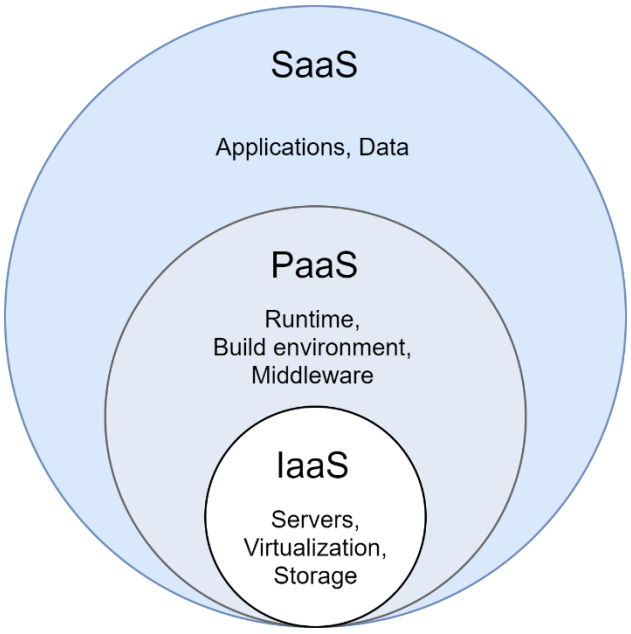

Figure 2.1 – Cloud computing services types

Out of the listed above opportunities in the Cloud computing software type, the most appropriate one is SaaS, because, unlike IaaS and PaaS, SaaS products are frequently marketed to both B2B and B2C users. According to a recent McKinsey & Company report, technology industry analysts predict further growth in the software as a service market and expect to see the market for SaaS products near $200 billion by 2024.

SaaS works through the cloud delivery model. A software provider will either host the application and related data using its servers, databases, networking, and computing resources, or it may be an ISV that contracts a cloud provider to host the application in the provider's data center. The application will be accessible to any device with a network connection. SaaS applications are typically accessed via web browsers.

SaaS applications and services typically use a multi-tenant approach, which means a single instance of the SaaS application will be running on the host servers, and that single instance will serve each subscribing customer or cloud tenant. The application will run on a single version and configuration across all customers or tenants. Though different

subscribing customers will run on the same cloud instance with common infrastructure and platform, the data from different customers will still be segregated.

The typical multi-tenant architecture of SaaS applications means the cloud service provider can manage maintenance, updates, and bug fixes faster, easier, and more efficiently. Rather than having to implement changes in multiple instances, engineers can make necessary changes for all customers by maintaining the one, shared instance.

Furthermore, multi-tenancy allows a greater pool of resources to be available to a larger group of people, without compromising important cloud functions such as security, speed, and privacy. The summary of SaaS advantages and challenges is presented in Table 2.1.

Table 2.1 – Comparison of SaaS advantages and challenges

SaaS advantages	SaaS challenges
• Flexible payments • Scalable usage • Automatic updates • Accesibility and persistence • Customization	• Issues beyond customer control • Customer looses control over versioning • Difficulty switching vendors • Security

SaaS removes the need for organizations to install and run applications on their computers or in their own data centers. This eliminates the expense of hardware acquisition, provisioning, and maintenance, as well as software licensing, installation, and support. Other benefits of the SaaS model include:

• Flexible payments. Rather than purchasing software to install, or additional hardware to support it, customers subscribe to a SaaS offering. Transitioning costs to a recurring operating expense allows many businesses to exercise better and more

predictable budgeting. Users can also terminate SaaS offerings at any time to stop those recurring costs.

- Scalable usage. Cloud services like SaaS offer high Vertical scalability, which gives customers the option to access more or fewer services or features on-demand.
- Automatic updates. Rather than purchasing new software, customers can rely on a SaaS provider to automatically perform updates and patch management. This further reduces the burden on in-house IT staff.
- Accessibility and persistence. Since SaaS vendors deliver applications over the internet, users can access them from any internet-enabled device and location.
- Customization. SaaS applications are often customizable and can be integrated with other business applications, especially across applications from a common software provider.

SaaS also poses some potential risks and challenges, as businesses must rely on outside vendors to provide the software, keep that software up and running, track and report accurate billing and facilitate a secure environment for the business's data.

- Issues beyond customer control. Issues can arise when providers experience service disruptions, impose unwanted changes to service offerings or experience a security breach – all of which can have a profound effect on the customers' ability to use the SaaS offering. To proactively mitigate these issues, customers should understand their SaaS provider's SLA and make sure it is enforced.
- Customers lose control over versioning. If the provider adopts a new version of an application, it will roll out to all of its customers, regardless of whether or not the customer wants the newer version. This may require the organization to provide extra time and resources for training.
- Difficulty switching vendors. As with using any cloud service provider, switching vendors can be difficult. To switch vendors, customers must migrate very large amounts of data. Furthermore, some vendors use proprietary technologies and data types, which can further complicate customer data transfer between different cloud providers. Vendor

lock-in is when a customer cannot easily transition between service providers due to these conditions.

- Security. Cloud security is often cited as a significant challenge for SaaS applications.

While analyzing the software available for managing complex logistics systems in Ukraine, the following package has been found as the most popular: “ORTY”, “ULTRA Restaurant”, “SmartTouch POS”. The comparison of software solutions for a restaurant business is provided in Appendix A.

2.2 Analysis of the Ukrainian restaurant business

The developed restaurant business is a profitable sector of the economy country, which, in addition to serving different categories of customers and providing their services in the field of nutrition, favorably positions the country's international market. Transformations that have taken place in the world economy in recent times decades have caused significant changes in the restaurant industry. A restaurant business is a profitable type of economic activity, which has high levels of capital liquidity and competitiveness. In addition, in recent years, there has been an increase in the role of the restaurant's economy in the tourism sector of the economy.

With the beginning of the economic transformation of Ukraine's economy, when profitability has become a key goal of business entities, there was a significant decrease in the number of restaurant facilities at institutions, industrial enterprises, educational institutions, etc., which serve consumers united by professional characteristics at the place work or study.

The structure of restaurants in Ukraine in 2012-2016 and the pace of their development is presented in table 2.2. As can be seen from the table data, in 2016 in Ukraine the largest share of the total number of restaurants establishments (48%) account for cafes and snack kiosks, which is due to the stable consumer demand for products and services of such restaurant business. Significant demand is observed for cafes, street food, snack bars. The share of restaurants (up to 35%) and bars (38%) has also increased significantly.

Table 2.2 – Ukrainian restaurant business types structure per 2012-2016 period

Type	2012	2013	2014	2015	2016	2016/2012 growth	2016/2015 growth
Restaurants	1460	1453	1472	2591	3488	139%	35%
Cafe	9049	8108	7434	9345	13866	53%	48%
Bars	2448	2266	2146	3856	5321	117%	38%
Canteens	9891	9665	9441	13546	18345	85%	35%
Total	22848	21492	20493	29338	41020	80%	40%

After the 2016 year, the Ukrainian restaurant business market has developed at quite a stable pace, and by 2019 it increased by 12%. But in 2020, the global pandemic of COVID-19 was exposed. According to the results of 2020, the number of restaurants and cafes in Ukraine decreased by 3850 units, according to a study by the analytical center "Restaurants of Ukraine" [35].

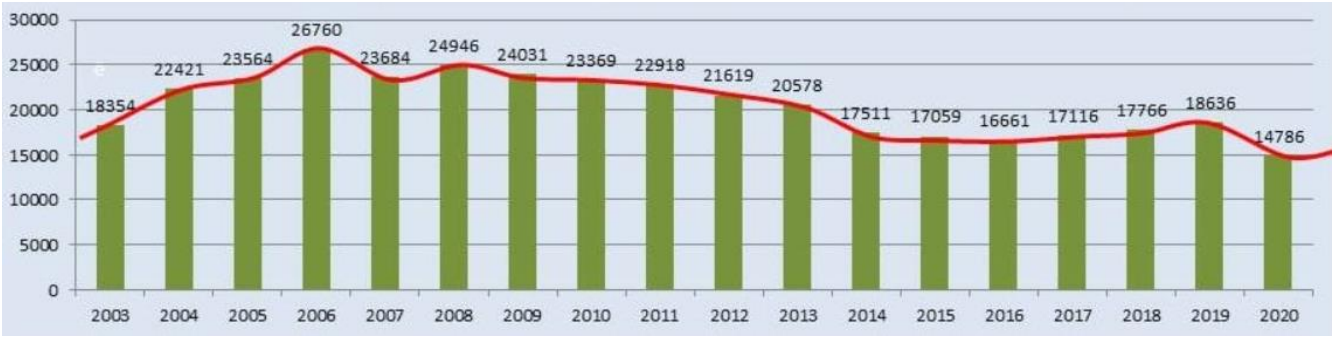

Figure 2.2 – Ukrainian restaurant market volume by the number of restaurants

Analyzing the data from Figure 2.2, there were identified such key points:

- At the beginning of 2021, there were 14,786 restaurants, cafes, and bars. While at the beginning of 2020 there were 18,636 institutions in Ukraine.
- The volume of the restaurant market decreased by almost 30% in 2020 and amounted to UAH 14.1 billion. The restaurant market lost almost UAH 6 billion.
- The main reasons for such rapid decrease were several lockdowns, quarantine restrictions on the restaurant business, and the lack of foreign tourists.

Consequently, after such perturbations on the restaurant business market in 2021, everyone has to significantly change all processes, at least to prevent closing the restaurant at all. While every third restaurant closes, and the restaurant can not physically work four times in a year and about three months in total, closing a restaurant even can be not the worst scenario, because many enterprises build their work on demand forecasts and taking credits to grow faster. But in the case of a global lockdown, these enterprises structure become the riskiest. In the next paragraph, it is described how MyFish company adapted to the new market environment.

2.3 Analysis of the MyFish company

Every restaurant is a complex logistics system with lots of informational inputs and outputs in its processes. To approve this assumption, the operational processes of MyFish company have been analyzed. MyFish is a fish restaurant and shop, based in the Hora village, near Kyiv via Boryspilske Highway. It includes a wide variety of seafood, fish, sushi, along with both alcoholic and non-alcoholic beverages (wine, beer).

According to the Rushton book, the main elements of logistics are storage and warehousing, packaging, inventory, transport, information, and control [37]. Admittedly, MyFish restaurant meets this requirement. MyFish restaurant has a warehouse for storing all needed goods. A warehouse is placed at the same building as the restaurant, so the step of moving materials between the warehouse and kitchen is eliminated for MyFish. The warehousing process is possible only with available inventory. To get this inventory delivered to the warehouse and restaurant, it should be ordered from suppliers. MyFish works with about 20 suppliers. The restaurant focuses on fish and seafood, so the biggest part of those suppliers are related to it. But, having analyzed the processes of MyFish, Figure 2.2 has been created.

It is visible that a major part of supplies is not food or beverages, there are supplies for maintaining restaurant infrastructure. Such supplies as furniture, uniform, kitchen equipment are ordered once while packing and wrapping materials, cleaning supplies, masks, and antiseptics should be ordered constantly. But all the items counted above are supporting goods. Supplying them to the restaurant does not make sense without the main products – fish, seafood, and beverages. The restaurant must relate to different main suppliers along with the opportunity to order goods from other distribution channels as a fallback.

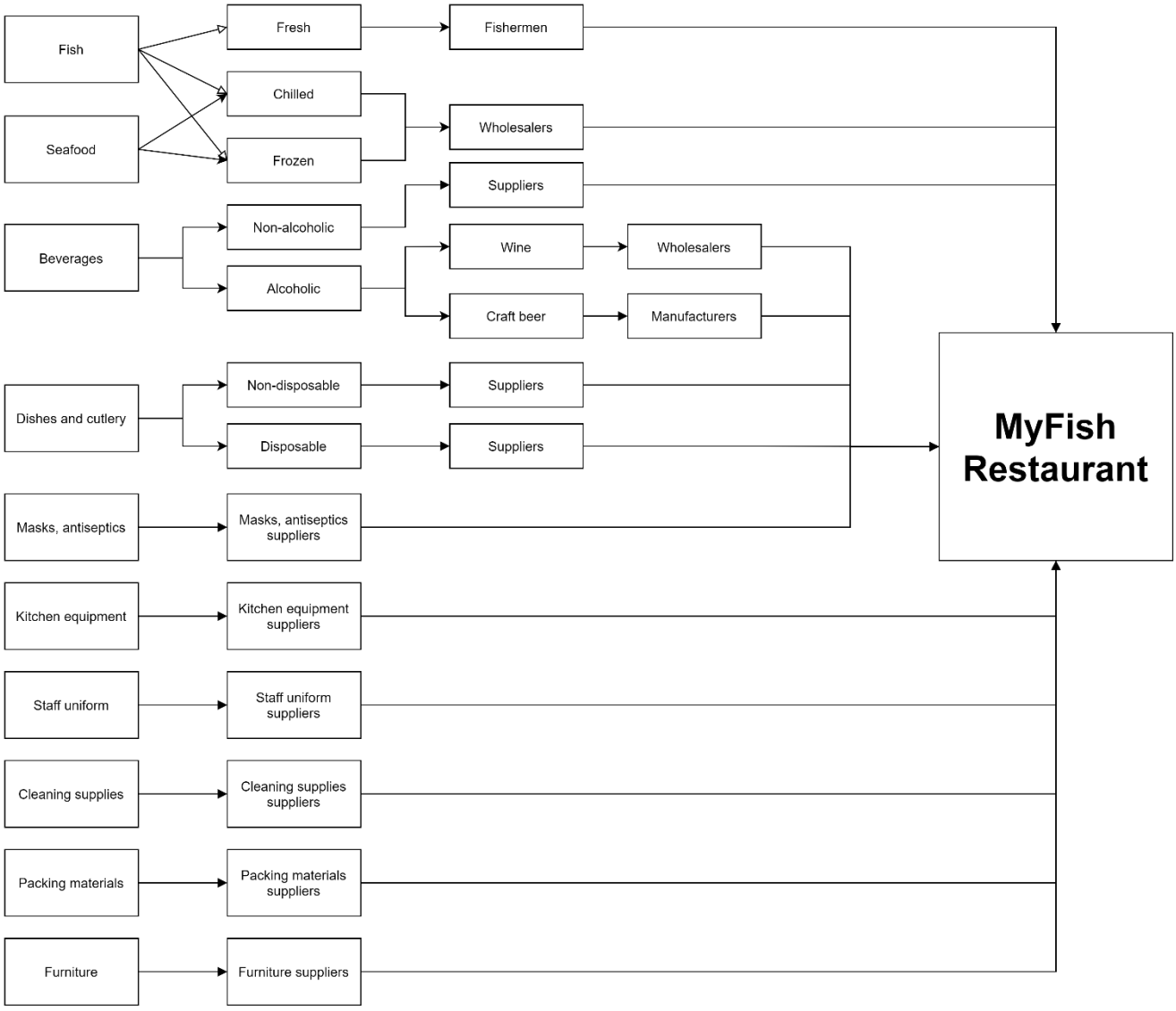

Figure 2.3 – MyFish supplies scheme

The main supplier of fish and seafood is the Global Fish company, which is located in Kyiv. Global Fish is a wholesaler and employs a solely contract-based partnership so transported goods should be ordered two weeks in advance. While working with lots of suppliers, the restaurant is weak to delays, which may significantly affect the business, so MyFish also works with secondary supply channels along with the primary ones.

The Stolychnyy Market and Volyn Wholesale Base serve as secondary sources of supply. Goods from these channels can be bought without any agreement through direct purchases. Besides, there are occasionally available fresh fish offers from fishermen in

neighboring villages. But the most important point in the fish and seafood supply process is its quality, so every supposed partnership with suppliers can be agreed upon only after MyFish chef ensures in quality of products.

As the company focuses on preparing and selling fish and seafood, these products represent the major part of available goods. Additionally, it is perishable food, so it should be packed in a vacuum and stored in the special fridges by each type of product. All goods that are being received from suppliers must be sorted by units, packed, and moved to the warehouse. Besides cooking dishes at the restaurant, MyFish has a delivery option. To move prepared dishes fast and warm, they should be properly packed.

The role of inventory in a logistics company is about the management of incoming and outcoming goods to the warehouse [37]. Also, it involves the customer demand analysis based on data about orders at certain periods of the year, and about dishes, which are being ordered more or and which are less. MyFish company has control over inventory processes. Furthermore, after involving the ERP software in the company structure, the effectiveness of this process will be significantly increased.

The most recognizable element in the logistics system transport. It includes all transport modes, such as road vehicles, aircraft, ships, trains, etc. Without transport, it is impossible to move between different points of the supply chain. MyFish does not need a big fleet of transport, because wholesale suppliers transport ordered goods directly to the restaurant. But it owns an electric car, which mostly serves for performing deliveries from restaurant to the customers. But sometimes, when goods from the main suppliers are not available, it serves as the vehicle for moving from secondary suppliers or buying and moving additional goods required.

MyFish company has a hybrid model of work. It works as a restaurant and as a shop at the same time. So, for a certain customer, there are different opportunities available, while he/she places an order. The product selling menu of MyFish is drawn in Figure 2.3.

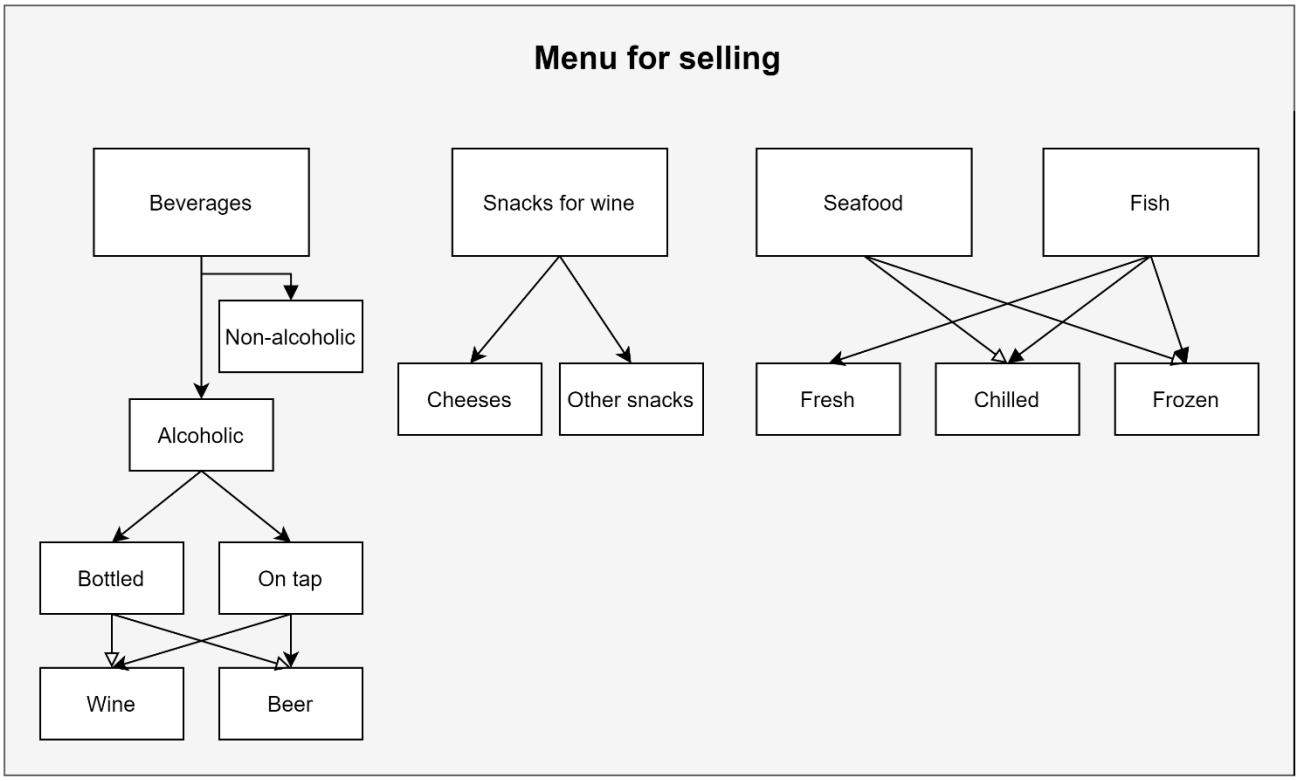

Figure 2.4 – Menu for selling products in MyFish

Menu for cooked fish and seafood has a wide variety of meals to be prepared for the customers. It includes the following categories: sushi, josper, friture, wok. Then, each category has its sub-items. MyFish menu is depicted in Figure 2.4.

For every seafood restaurant, it is necessary to have a sushi menu. MyFish manager thinks the same way and decided to hire a sushi master, who works independently of a chef. With such a wide range of seafood, MyFish has an opportunity to provide products for cooking the most popular types of sushi in California and Philadelphia, along with different variants of Nigiri and Gunkans, which can not be found everywhere.

Another category of the MyFish menu is a Josper menu. The Josper Oven's defining feature is its ability to multi-task, searing smoking and grilling all at the same time. Its

unique design also cooks food faster than a conventional oven. A Josper oven also offers a fast, dry heat to create irresistible crisp and charred dishes. As it functions like an indoor barbecue, it retains the moisture and flavor of fish when the fish is kept behind closed doors within the oven. Almost all types of fish and seafood in MyFish restaurant can be prepared in Josper.

In short, friture is frying a product in a large amount of hot oil. MyFish has a new part of the menu with shrimps and mussels in friture.

And the newest part of MyFish menu is the WOK menu. WOK is a deep round-bottomed cooking pot that originated in China. MyFish provides different noodles cooked in WOK with seafood.

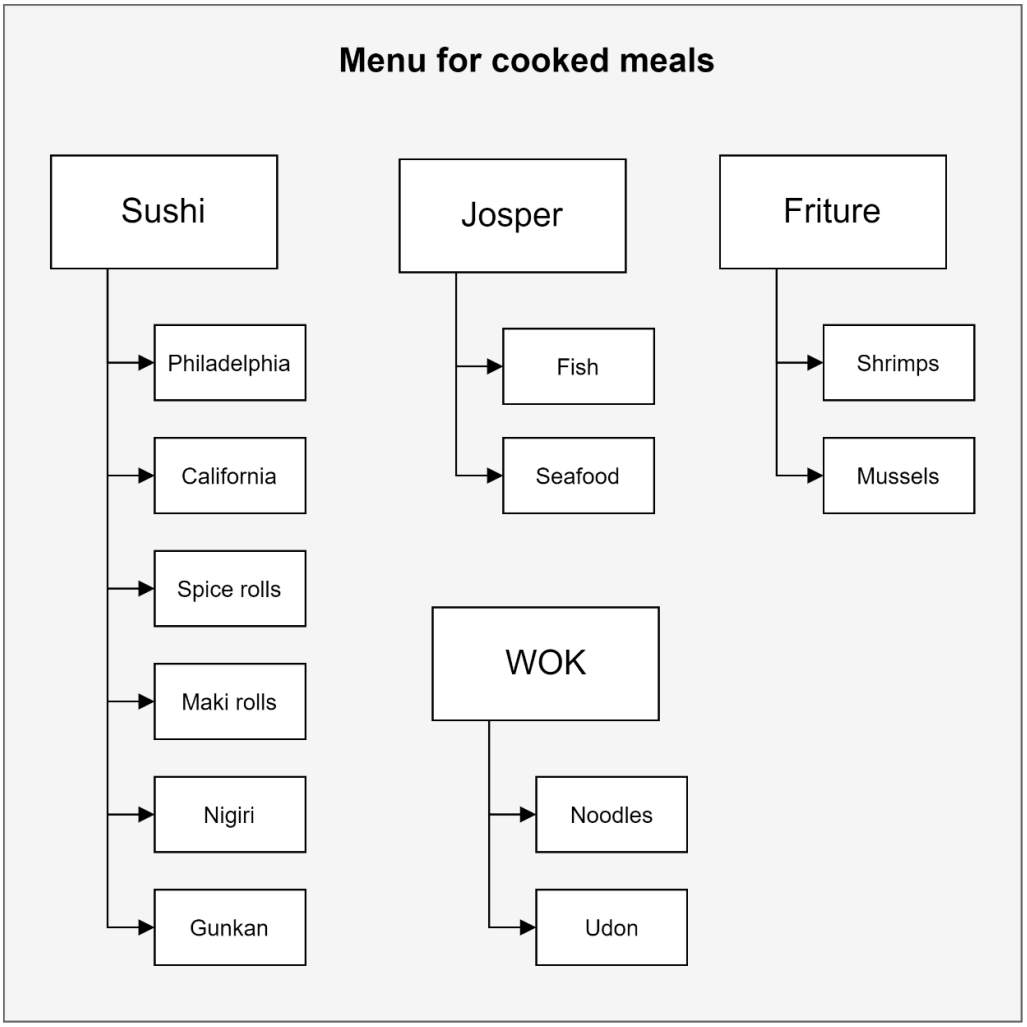

Figure 2.5 – Menu for cooked meals in MyFish

Information and control in a logistics system include all activities which are focused on increasing the effectiveness of logistics processes. Generally, the main instrument for doing this is well-organized information throughout all departments of the company. MyFish company's organizational structure is common to the basic structure of each restaurant. It is depicted graphically in Figure 2.5.

The board consists of three co-founders, and the main operations processes are directed by the general manager. Then, as MyFish structure is the combination of fish restaurant and shop, employees are split into three groups: accounting staff, shop staff, and kitchen staff.

- The accounting staff is vital for every company, and in MyFish it consists of a financial accountant and inventory accountant. A financial accountant calculates, and pays all needed taxes, fees and generally keeps track of money flows within the company. But inventory accountant is needed to keep records of all supplies, deliveries, and general movement of materials within the company.
- Shop staff in MyFish has an administrator, who manages waiter, salesman, and cleaner. An administrator is a person who is responsible for the appropriate shift, and he/she can be changed depending on the schedule. Sometimes on the shifts with low expected demands, the shop staff can be reduced by the only administrator and waiter, to serve the customers. It is done to reduce unneeded expenses per shop personnel, exactly during the COVID-19 lockdown limits.
- The kitchen staff contains the biggest number of employees. The chef is responsible for creating and updating the menu, managing cooks and assistants, and keeping all meals prepared exactly according to the receipt requirements. Another employee in the kitchen staff does not depend on the chef, because he is responsible only for the sushi part of the menu. So, he has functions similar to the chef’s, but only in the scope of sushi. He has not people who report to him, so unlike the chef, who has a majority of management jobs, the sushi master has to prepare every order by himself. And the last kitchen employee is the fish cleaner, which can be considered as not very important, but in terms of fish and

seafood delivered from the whole world, fish cleaner is vital, because the first step of preparing premium quality fish and seafood – cleaning it up.

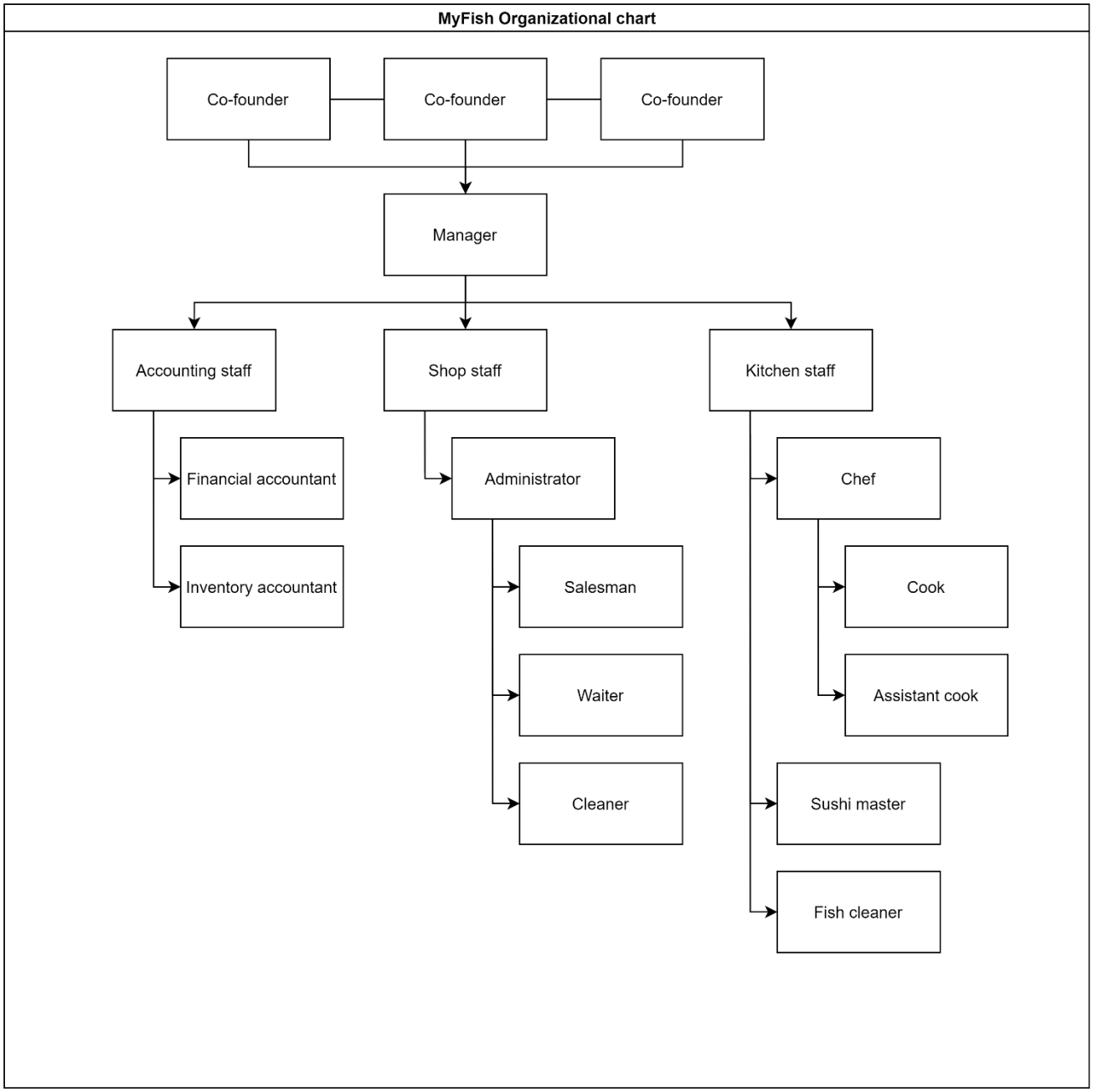

Figure 2.6 – MyFish organizational chart

Nevertheless, to manage a restaurant successfully, a lot of factors must be considered and analyzed from different perspectives. One of the most popular solutions for analyzing all necessary factors is the SWOT analysis. The acronym SWOT stands for strengths, weaknesses, opportunities, threats. It is done in the format of a table or matrix. The first two columns – strengths, weaknesses mean analyzing all details that a company can control. Another two – opportunities and threats, describe the details which are not controlled by the company, but influence it, positive and negative, accordingly.

Table 2.3 – Strengths and weaknesses of MyFish company

Strengths	Weaknesses
• Wide assortment of seafood and wines • The majority of wines available in MyFish is not sold in supermarkets • Good location • Vegetarian friendly • Delivery is available	• No summer terrace • Limited square and seats • Delivery coverage is limited to nearby villages and the edge of Kyiv left bank • Weak promotion of a website for selling fish comparing to competitors
Opportunities	**Threats**
• Fish and seafood are in demand because of the trend on healthy food • Kyiv's agglomeration continuously expands • Buy advertisement on a highway which leads to the restaurant location Increase volume of food sold over the website	• COVID-19 pandemic • Meat shop at the same building • Implementation of summer terrace is forbidden by a lessor The price of seafood is volatile because of the complex supply chain

Analyzing the market positioning of MyFish company, there have been implemented SWOT analysis in Table 2.3.

MyFish works with a big number of suppliers through special partnership programs. It provides to gain a competitive advantage over other restaurants in the market because the variety and quantity of available goods can be easily compared with each of the competitors in this market.

The geographical position of a restaurant is beneficial because of the following factors: Village Hora is not far from Kyiv, about 15 kilometers. It is located straightly near Boryspilske highway. It serves as a transport hub because placed at the intersection of Boryspilske Highway, which leads to Boryspil city and airport, and the road which leads to other villages. And it is important to understand, that there are not usual Ukrainian villages with a poor level of life. They are situated in the scope of the Kyiv agglomeration. Kyiv is the most populated city in Ukraine, and it continues to spread out in sibling cities and villages. The quality of life in these villages is high enough because there live people who prefer living in their own house instead of a flat in the city. It is important to consider, that all of the main competitors who work in the same market as MyFish, do not have their restaurant or shop in the close neighborhood to MyFish, so in this district, MyFish has a pole position.

2.4 Conclusions to Chapter 2

The analysis of the Ukrainian restaurant business market has shown that market the volume of restaurants on the market has been continuously increasing from 2016 to 2019 years, but in 2020 it has suffered because of the global COVID-19 pandemic. It resulted in a reduction in the restaurant quantity in Ukraine by 30%. So, this situation dictated

simple rules: adapt and survive or die. MyFish company decided to adapt to the new market environment by changing its structure from the only restaurant to the combination of restaurant and shop. This helped the company to continue working as a shop during the lockdowns when restaurants' work was blocked. Then, MyFish bought a vehicle for performing delivery in the neighboring villages and cities and served customers in takeaway mode.

On the other hand, the analytical part of the work comprises the description and comparison of different Cloud-based solutions, such as PaaS, IaaS, and SaaS. There was chosen SaaS as the most appropriate solution which meets MyFish requirements. To solve the problems described in the first part of the thesis, the software should have a well-organized data structure, along with a simple and predictable user interface.

Another point of the analytical part of the thesis is the analysis of MyFish restaurant&shop as a complex logistical system. There are described suppliers by goods categories, sub-categories, and quantities, main and secondary supply channels are identified, and the inventory management of a restaurant is described. Also, this part includes MyFish competitors and SWOT analysis, along with the organizational structure of the enterprise.

CHAPTER 3
INFORMATION SUPPORT DESIGN FOR A LOGISTICS COMPANY

3.1 Software applied in MyFish company

According to the definition in the previous chapters, the paper topic is the software design for a logistics company. A practical description of this process should be provided in this part of the work.

Usually, after receiving a task to create any software, the development team has to streamline the process of implementing an application from scratch. The first and main part of any application is the database because it stores all data. So, it is extremely important to organize it properly and reliably. For doing this, a lot of solutions are available, and one of the most effective ones is depicting entities of the database graphically.

As the team uses a relational database, the proper connection between entities should be done. In databases, an entity is a thing, object, or any item, about which the data should be captured and stored in form of tables and properties. Appendix B depicts the scheme of entities of the application. Databases usually have the same schemes, but instead of entities, the data are described in tables. The table is the list of entities. For example, the database contains five employees. Their structure is the same because each of them has the same type - Employee. But they are placed on the table Employees. This is how databases are described.

Each entity has a unique identifier, the Id field is responsible for setting it. Unique identifiers provide an opportunity to link the related fields of different entities between each other. For example, a Product has a field Supplier Id. Logically, this is the Id field of the Supplier entity. As the Id of Supplier entity is linked to the Supplier Id field in the

Product entity, it allows using the same data in all places, which are connected to it. It is a major advantage of relational databases because once data is updated anywhere in the DB, it will be updated in all tables which are connected there. Arrows display the relations between fields of the entities.

To improve the readability of the scheme, it is split into 3 parts: Procurement, Products, Sales. Also, there is an additional 4th part, which contains Employees. The main part of an application is Products because it is related both to Procurement and Sales processes. And it is easy to find out that the Product entity has the biggest number of relations.

Procurement comprises a part of an application that interacts with the process of ordering and buying goods from suppliers. So, there are the following entities that are responsible for procurement processes: Supplier, Supplier Payments, Order, and Order Item. The main entity here is Order because procurement activities primarily focus on specifying needs in any resources or raw materials. Then based on this info, the company makes orders to the suppliers. Order consists of basic general info, while items, which are being ordered are placed in another table. Order items have more detailed info about all measurements and quantity of the goods which the company receives after order completion.

Another important step of the procurement process is collecting the data of a restaurant on suppliers. With such data as delivery price, location, date, it becomes possible to analyze the suppliers and select the most appropriate ones. Supplier payment is separated into another entity because it includes basic details about money transactions between the restaurant and suppliers. Besides, this also provides an opportunity to perform data reports and analyses.

A detailed explanation of each entity in the database is provided below.

Supplier
Id
Name
Contact Info
Location
Delivery price
Bank Account Number

Figure 3.1 – Supplier entity

An entity that describes suppliers have such fields as: Name, Contact Info, Location, Delivery price, and Bank Account Number. Name and contact info fields contain basic supplier information, and they are not necessary for further analysis. On the other hand, location delivery price and bank account number are required for different types of analysis and for further identification, how to choose the most effective one based on the counted fields.

Order
Id
Date
Status
Supplier Id
Employee Id
Total price

Figure 3.2 – Order to the supplier

Order entity describes the order send to Supplier, so it related to Supplier Id. Also, it relates to Employee Id, for tracking the effectiveness of personnel in the MyFish company. Status is needed for real-time tracking of an order. Date and Total price are needed for reports and analyses.

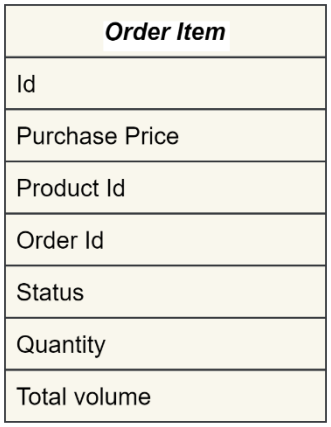

Figure 3.3 – Order Item

Order Item entity describes the items that each supplier's Order contains, so it relates to Order. Also, it relates to Product which provides information about the goods expected from the supplier. Status field describes the nature of each item, for example, it can be raw, semi-finished, etc. Quantity and Total volume information are needed for further storage of the goods at the warehouse. Purchase price of Order Item is needed for further reports and analyses.

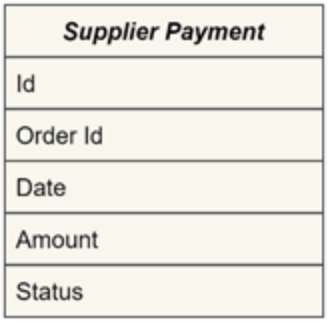

Figure 3.4 – Supplier Payment

Supplier Payment entity describes the details of money transfers between MyFish and suppliers. It relates to Order because payments are done only for ordered goods from suppliers. Status is needed for real-time tracking of transactions performed. Date and

Amount are needed for further reports and analyses. And generally, the Supplier Payment table is needed for financial accounting.

Product
Id
Name
Category Id
Sub-category Id
Measurement Type Id
Volume
Supplier Id

Figure 3.5 – Product

Product entity describes involves a major part of restaurant activities. It has the biggest number of relations because the product passes the whole supply chain: it is being ordered from the supplier, received and stored at the warehouse, picked at the kitchen, and added as a part of a certain meal.

Supplier Id is needed to relate the product with the corresponding supplier.

Category Id and Sub-category Id are needed to separate the product from others to simplify the process of adding product to the meal.

Measurement Type Id and Volume are needed to simplify the process of storing the product at the warehouse, and for further inventory accounting.

Category
Id
Name

Figure 3.6 – Product category

Category entity describes the categories of products for their further separation, reports, and analyses. It is a simple key-value entity.

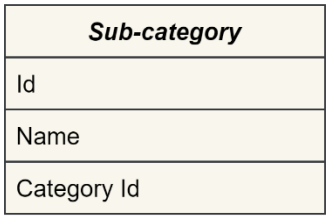

Figure 3.7 – Product sub-category

Sub-category entity describes the sub-categories of products for their further separation, reports, and analyses. It is related to Category.

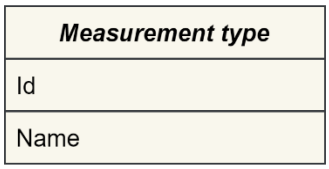

Figure 3.8 – Product measurement type

Measurement type entity describes the measurement types of products to simplify the process of storage and inventory management. It is a simple key-value entity.

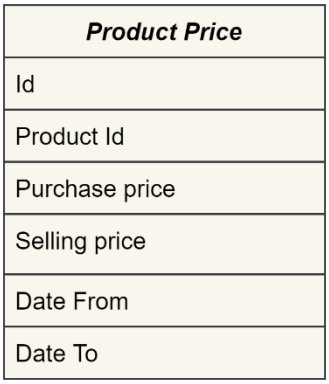

Figure 3.9 – Product Price

Product Price entity describes the details about prices of a product. It relates to Product. Purchase and Selling prices are needed for further financial accounting. It requires Date From and Date To fields because prices per different products at the market

are being changed quite often, so it is important to consider this in further financial accounting.

Menu Item
Id
Name
Menu Category Id
Menu Subcategory Id
Price

Figure 3.10 – Menu Item

Menu Item entity describes the general information about each record in the MyFish menu. It relates to Menu Category and Sub-category. These fields are needed for a more detailed separation of data in reports. Price is needed for further reports, analyses, and financial accounting.

Menu Item Product
Id
Menu Item Id
Product Id
Volume
Selling Price

Figure 3.11 – Menu Item Product

Menu Item Product entity describes the detailed information about products used in each item in the menu, so it relates to the Menu Item entity.

It relates to Product Id, which is used in a certain meal in the menu, and it is needed for further reports and analyses.

Volume is needed for just-in-time inventory management, and Selling Price is needed for further reports and analyses.

Menu Category
Id
Name

Figure 3.12 – Menu Category

Menu Category entity describes the categories of menu items for their further separation, reports, and analyses. It is a simple key-value entity.

Menu Sub-category
Id
Name
Menu Category Id

Figure 3.13 – Menu Sub-category

Menu Sub-category entity describes the sub-categories of menu items for their further separation, reports, and analyses. It is related to Menu Category.

Customer Order
Id
Date
Status
Payment Type
Employee Id
Total price

Figure 3.14 – Customer’s Order

Customer’s order entity describes the general information about certain order of a customer. It relates to the Employee entity, which is needed for further analysis of the effectiveness of service personnel employees. Status is needed for real-time tracking of the preparation of a meal, also it is needed if a meal is ordered via delivery.

Payment Type, Total price, and Date are needed for further reports, analyses, and financial accounting.

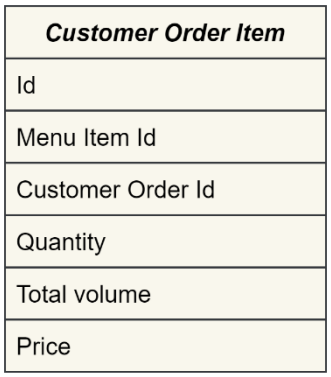

Figure 3.15 – Customer Order Item

Customer Order Item entity describes the detailed information about certain orders of a customer, so it relates to Customer Order. Also, it relates to Menu Item, because each order consists of menu items.

Quantity is needed for calculating the menu items expected to be prepared for a certain order. Total volume is needed in the case if the customer wants to buy just packed product in takeaway format, not a meal. Also, both are further needed for inventory management, reports, and analyses.

Price is needed for further reports, analyses, and financial accounting.

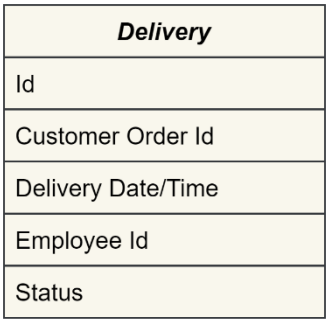

Figure 3.16 – Customer Order Delivery

Customer Order Delivery entity describes the information only about an order that a certain customer ordered via delivery. It relates to the Customer Order entity. It also relates to the Employee, which will deliver it to the customer. It is needed for measuring the effectiveness of delivery personnel. Status is needed for real-time tracking at which point of the process does order appear.

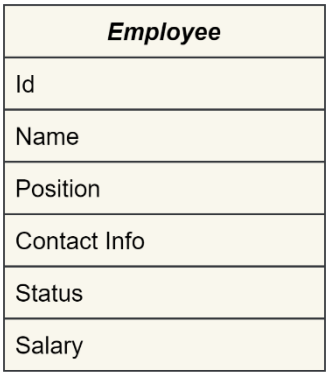

Figure 3.17 – Employee

Employee entity describes the general information about a certain employee. Name and Contact Info are needed to connect with an employee when needed and to keep an account on him in the program. Position and Salary are needed for further reports, analyses, and financial accounting. Status is needed for real-time tracking, what does

every employee do at a certain time. For example, status can have such values as: serving customers, taking a break, delivering, leave, holiday, etc.

Figure 3. 18 demonstrates the scheme of information flow within the ERP system for a MyFish restaurant. It depicts several points: Database, Supplier, Products, Procurement staff, Warehouse, Dishes, Restaurant staff, Customer, Analytics and Reports.

The main source of information in any software is the Database. It stores all data of the application in the relational tables. The method of data structuring is described in the previous paragraph.

It is visible, that majority of elements have two-way data interaction with the database. All information changes and updates must be added to DB.

Here is described the basic flow of information in a fish restaurant. Before getting a ready-to-eat dish at a customer's plate, a lot of processes must be performed.

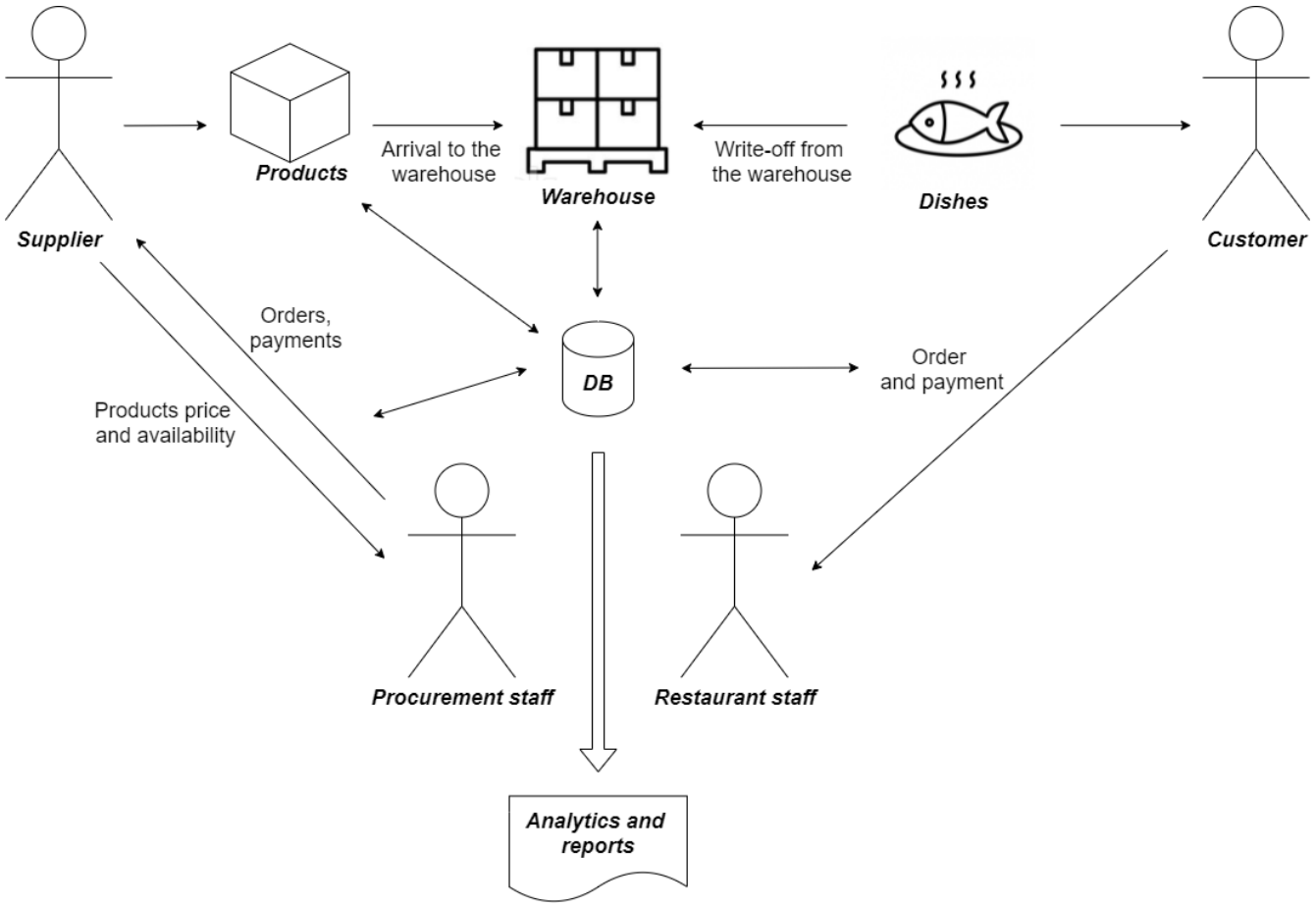

Figure 3.18 – Information flow within the MyFish restaurant

Firstly, the company orders products from suppliers. Suppliers provide information about the availability of needed products and their prices to the procurement department of a company. Also, the information about suppliers continuously recorded in the DB. If the products are available and their price is appropriate, the company sends information in form of an order, where the volume, quantity, and date of expected arrival are provided, and pays the order to complete it. The general order information is added to the database.

Secondly, after successful order completion, suppliers transport the products directly to the restaurant's warehouse. When products arrive, the operating staff inputs information about received goods into the system, so it is being added to the DB in the Orders table with status completed, and in the Warehouse Items table to update the list of products available at the warehouse. All data changes of products that are stored at the warehouse continuously update the information about them in the database.

The third part of interactions in the restaurant is done between restaurant staff and customers. Customer provides information about what dish or beverage he/she wants to order, the waiter receives it, and inputs into the system. When a customer order is completed, the system calculates the quantity and volume of products required for dish preparation and then writes them off from the warehouse. As a result, the order is added to the Customer Orders table with status completed, and it deletes the products, which were used for order preparation, in the Warehouse Items table in the DB.

As the result of the whole cycle of information movement between elements, the latest changed data is always located in the database. As this cycle runs every day, the management department of the company becomes provided with the information for its further analysis and preparing reports based on it. This is one of the most important functions in any ERP system.

Properly structured data in the representative amount provide the opportunities to define and eliminate bottlenecks at each stage of the process, analyze the different suppliers, make customer demand forecasts, keep the products fresh, adapt the number of products by demand, etc.

3.2 Economics component of implementing software for the MyFish company

It is known that the productivity and efficiency of the automated system are determined by comparing the results of its work and the cost of all types of resources required for its creation and development. Investments in the creation of a software product are calculated by formula 3.1.

$$K = К_1 + К_2 + К_3$$

(3.1)

where K1 - equipment costs, UAH;

K2 - costs of licensed software products, UAH;

K3 - costs for creating a software product, UAH

We accept K1 = 0, because all companies use computers for their work, K2 = 7000, because the necessary licensed software products must be purchased, namely (MS SQL). The cost of creating a software product K3 is calculated by the formula (3.2).

$$К_c = C_1 + C_2 + C_3$$

(3.2)

where C1 - labor costs of developers, UAH;

C2 - computer time costs, UAH;

C3 - indirect (overhead) costs, UAH.

Labor costs of developers:

$$C_1 = \sum_{k=1}^{k} N_k * r_k * T_k * K_{sal}$$

(3.3)

where N_k - the number of developers to the profession, people;

r_k - hourly salary of the developer to the profession, UAH;

T_k - the complexity of development for the developer (the amount of time spent by the developer), hours;

K_{sal}= 1.3685 - coefficient of deductions to the salary fund.

Assume that $N_k = 3$, because 3 programmers participated in the development of the software product. in the hourly wage of the employee is calculated by the formula:

$$r_k = {M_k}/{F_k^{mth}}$$

(3.4)

where M_k – monthly salary of the developer, UAH;

F_k^{mth}– monthly fund of his work time, hour.

We accept the monthly salary of a developer in the Kyiv region equal to 10000 UAH, then we have that the number of calendar days – 365, the number of holidays - 10, the number of weekends - 104, the number of days in which work is not carried out - 114, the number of working days - 251, the number of days preceding the holiday, in which the working day is shorter by 1 hour per day - 4. Total working hours per year, with a 40-hour working week - 2004 hours. Total working hours per month - 2004/12 = 167 hours. Then, the hourly salary of the developer, given will be calculated as (3.4):

$$r_k = \frac{10000}{167} = 60\ uah/hr$$

The complexity of developing T_k includes the time of work and in this. The case is equal to 195 hours. Now calculate the labor costs of the developer:

$$C_1 = 1 \cdot 60 \cdot 167 \cdot 1{,}3685 \ = \ 13{,}712 \text{ uah}$$

The cost of computer time is calculated by the formula (3.5).

$$C_2 = C_{comp} + T_{comp}$$

(3.5)

The cost of a computer hour is calculated by the formula 3.6.

$$C_{comp} = C_A + C_{el} + \ C_{TS}$$

(3.6)

where C_A - depreciation deductions, UAH;

C_{el} - energy consumption, UAH;

C_{TS} – technical support costs, UAH

Depreciation deductions are found by the formula 3.7.

$$C_A = C_i * N_A / F_{hrs}$$

(3.7)

where C_i = 8000 UAH. - book value of the i-th equipment used for creation, UAH;

N_A - annual rate of depreciation of the i-th equipment, share;

F_h - annual time fund of the i-th equipment, hour

According to the current legislation, the quarterly depreciation rate of fixed assets of group 4, which were involved in the development is 15%, then the annual depreciation rate will be equal to N_4 = 0.6.

$$F_h = 2004\ hours.$$

$$C_A = 8000 \cdot 0{,}6/2004 = 2{,}4 \text{ UAH.}$$

Energy consumption is calculated by formula 3.8:

$$C_{el} = P_{el} + C_{kWt} \tag{3.8}$$

A modern model computer consumes an average of 800 Watts per hour, then $C_{el} = 0.08$ kW / h. The cost of 1 kW / h for consumers of the second class (non-industrial enterprises) is 0,194754 UAH per kW / year.

$$C_{el} = 0.08 * 0.194754 = 0.0155 \frac{uah}{hr}$$

Technical support costs are calculated by formula 3.9.

$$C_{TS} = r_{TS} * \lambda \tag{3.9}$$

where r_{TS} – hourly salary of the employee of the service equipment, UAH;

we accept $r_{TS} = 3000/167 = 19.1$ UAH/h

λ – service periodicity (3.10):

$$\lambda = N_{TS} * F_{mth} \tag{3.10}$$

where N_{TS} – the number of equipment technical support per month, we accept $N_{TS} = 1$;

The monthly fund of equipment operation time is 167 hours.

$$\lambda = 1/167 = 0.006$$

Technical support costs will be: $C_{TS} = 19.10 \cdot 0.006 = 0.114$ UAH. Hence the cost of a computer hour: $C_k = 1.85 + 0.0744 + 0.114 =$ UAH 2.03. Therefore, the cost of computer time will be: $C_2 = 2.03 \cdot 195 = 395.85$ UAH.
We will accept indirect costs: $C_3 = 450$ UAH / month. Hence $K_3 = 450 + 395.85 + 13.712 = 14557.85$ UAH. The costs of creating a prototype of the automation system are: K = 0 + 7000 + 14557,85 = 21557,85 UAH.

Now it is possible to calculate the annual effect of the implementation of an automated system and the payback period of the system. It is known that in the average restaurant that keeps journal records, orders from the customer are registered in an average of 10 minutes. Let's take for calculations that 2 cash desks worked in the establishment before the introduction of the automated system. With the help of the created automated system registration of the order takes an average of 4 minutes. This will speed up customer service and eliminate the need for a second cash register. The average employee who registers an order in a catering establishment receives a minimum wage of 8000 UAH per month. Then the wage bill per employee averages 96000 UAH per year. If we can avoid the creation of a second cash register, then the annual savings from the introduction of an

automated system $E_p = 96000$ UAH . Then we calculate the payback period of investments - the time during which the recouped costs of the automated system are determined by the formula:

$$T_p = \frac{K}{E_p} \tag{3.12}$$

$$T_p = 21557{,}85 / 96000 = 0{,}225 \text{ years}$$

With the effective investments strategy, the estimated payback period T_p should be less than the normative $T_n = 2{,}4$, in our case it is achieved. So, as we see, the development and use of a software product are economically feasible, as the annual savings will be 96000 UAH per year, and the payback period of investments in the automated control system is 0.225, ie the project will pay off in less than one year.

3.3 Conclusions to Chapter 3

In the theoretical and analytical parts, there were identified such bottlenecks in the operational process of MyFish enterprise as: long delivery time, the big impact of human errors, improper transportation system structure, unoptimized routine functions, and high overhead costs. The most relevant ones, which are successfully solved after optimizing an informational flow with LMS software are the following: the big impact of human errors, unoptimized routine functions, and overhead costs.

Human errors are solved through the implementation of a streamlined user interface with as few manual string inputs as possible, except login and password fields. The UI mainly consists of prompts with predefined options. The implementation of such

functionality takes the same effort as an implementation of inputs, but this results in a significant reduction of typo errors.

Unoptimized routine functions are solved through meticulous design of the system data structure, where the relationship of all functional units between each other of the program is documented according to the best practices of software development for enterprises. With this structure, the functional part of the application provides the tools for performing a wide range of reports and analyses. Previously, there was an inventory accountant who calculated all inputs and outputs of information regarding inventory manually. With the software, it can be done rapidly without any need of using manual calculation by the employees in charge.

Overhead costs issue is solved by financial calculating of gains for the MyFish after involving the software in the organizational structure. The number of costs is displayed in the financial report, which will be later processed through the developed software, and the break-even point result can be achieved within less than half of a year.

CONCLUSIONS AND RECOMMENDATIONS

In 2021, during the period of active usage of Cloud technologies along with Big Data, it involves every complex system, with a big amount of information inputs and outputs. To utilize these solutions effectively, there was defined a separate direction of software development. It includes IaaS, PaaS, and SaaS. SaaS contains all needed functionality to implement and run ready-to-use software in the Cloud. SaaS has evolved significantly over the recent years and it transitioned from an on-premise model to a fully Cloud-based one. While earlier there were needed full setup of the software on each physical computer, now it is based remotely and can be accessed from every device that has a connection to the Internet. It is easily identified, that the flexibility of Cloud-based SaaS software is gradually higher compared to the on-premise solutions which recently became a legacy.

This work comprises the optimization of information flow within the MyFish logistics company. It operates in the restaurant business market. As a type of work, MyFish has a hybrid structure, both restaurant, and shop. Regarding the supply chain, MyFish has a wide variety of suppliers, but the major part of them deliver the goods directly to the facility. It seems like the supply chain is simple, but after performing an analysis in the analytical part, there were identified that the supply chain of MyFish has a wide range of informational inputs and outputs both internally and externally in the scope of an enterprise. So, MyFish restaurant meets the concept of the logistical system according to the theoretical research in terms of this paper. Also, while collecting the information about MyFish company, there were identified the following problems, that were solved by correctly involved software: human error, routine functions, overhead costs.

In the analytical part of this work, different solutions were compared and analyzed, and this part inquiry the comparison of main types of software for logistics management, such as ERP, WMS, TMS. As the complex logistical systems require the appropriate

software, MyFish decided to hire developers for implementing the ERP software for the management of logistics processes within the company. Analyzing the available approaches to organizing the development process, the Scrum framework has been chosen. Another part of the analytical part comprises the ongoing processes of MyFish restaurant and shop. There were provided an organizational structure of the enterprise, market positioning, SWOT analysis, menu, and other internal and external information about MyFish company.

In the practical part, the involvement of software in the organizational structure of MyFish was analyzed and described, along with an analysis of the financial effect of the implemented solution. After receiving the technical task, the team started by the structuring of data management in the application. To perform this process conveniently, all units of the program were described and their relationship was defined in form of tables that contain corresponding entities. Also, the full data flow of the application was described for its further support and maintenance.

As the result, MyFish company has solved all problems described in the initial part of work, and from a financial perspective, the company reduced overhead costs on salary for the employee which became unneeded after involving the software in the company operations. Moreover, after less than half of a year, MyFish covered the software development costs.

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Appendix A

Logistics software solutions comparison table

	ORTY				**ULTRA Restaurant**			**SmartTouch POS**		
Pricing Plans	< 30 orders per month	< 100 orders per month	< 200 orders per month	Unlimited orders per month	ULTRA Lite	ULTRA Business	ULTRA Premium	Lite	Basic	Standard
Price	280	840	1400	2800	259	519	759	168	252	560
Features	Without fee, Own application and website, Takeout, delivery, QR orders, CRM, Delivery and carrier integration	Without fee, Own application and website, Takeout, delivery, QR orders, CRM, Delivery and carrier integration, Chatbots integration, Cashback	Without fee, Own application and website, Takeout, delivery, QR orders, CRM, Delivery and carrier integration, Chatbots integration, Cashback	Without fee, Own application and website, Takeout, delivery, QR orders, CRM, Delivery and carrier integration, Chatbots integration, Cashback	Inventory, Warehouse, Exchange data with remote points, Analytics	Ultra Lite features, Production, Calculation, Orders and returns printing, Loyalty program, Events planning, 1C integration	Ultra Business features, Financial accounting, Email, sms campaign, Time reports, Food delivery, Time management	Inventory: Unlimited, Statistics: 40 days, Warehouse management: No, Employee shifts: No, 1C integration: Yes, Loyalty program: No, Menu for customer: No, Transactions: Unlimited, Support: Included, Additional tablet: +168 uah	Inventory: Unlimited, Statistics: Any period, Warehouse management: Yes, Employee shifts: Yes, 1C integration: Yes, Loyalty program: No, Menu for customer: No, Transactions: Unlimited, Support: Included, Additional tablet: +252 uah	Inventory: Unlimited, Statistics: Any period, Warehouse management: Yes, Employee shifts: Yes, 1C integration: Yes, Loyalty program: Yes, Menu for customer: Yes, Transactions: Unlimited, Support: Included, Additional tablet: +252 uah

Appendix B

Entity relationship diagram