

МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ РОССИЙСКОЙ ФЕДЕРАЦИИ

ФЕДЕРАЛЬНОЕ ГОСУДАРСТВЕННОЕ АВТОНОМНОЕ
ОБРАЗОВАТЕЛЬНОЕ УЧРЕЖДЕНИЕ ВЫСШЕГО ОБРАЗОВАНИЯ
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ЛОГИСТИКА

МЕТОДИЧЕСКИЕ
УКАЗАНИЯ
К ЛАБОРАТОРНЫМ
РАБОТАМ

GUIDELINES
FOR LABORATORY
CLASSES IN LOGISTICS

Рекомендовано редакционно-издательским советом федерального государственного автономного образовательного учреждения высшего образования «Самарский национальный исследовательский университет имени академика С.П. Королева» в качестве методических указаний к лабораторным работам для студентов Самарского университета, обучающихся по основной образовательной программе высшего образования по направлению подготовки 38.04.02 Менеджмент

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Методические рекомендации разработаны в соответствии с требованиями Федерального государственного образовательного стандарта высшего образования по направлению подготовки 38.04.02 Менеджмент (уровень магистратуры).

Предназначены для студентов института экономики и управления, обучающихся по направлению подготовки 38.04.02 Менеджмент – магистерская программа «High-Technology Business Management» при выполнении лабораторных работ по дисциплине «Логистика» (Logistics).

Объясняется порядок выполнения лабораторных работ, их тематика, содержание и продолжительность, цель и задания на каждую лабораторную работу, указана рекомендуемая литература, представлена форма и содержание отчета по итогам лабораторной работы, а также подходы и критерии к его оценке.

Данные методические указания могут использоваться для проведения лабораторных работ по дисциплине «Управление цепями поставок» (Supply Chain Management) для направления подготовки 38.04.02 Менеджмент.

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INTRODUCTION

Logistics and supply chain management are not new ideas. From the building of the pyramids to the relief of hunger in Africa, the principles underpinning the effective flow of materials and information to meet the requirements of customers have altered little.

The elements of logistics and the supply chain have always been fundamental to the manufacturing, storage and movement of goods and products. It is only relatively recently, however, that they have come to be recognized as vital functions within the business and economic environment. Logistics has developed. Now it plays a major part in the success of many different operations and organizations. In essence, the underlying concepts and rationale for logistics are not new. They have evolved through several stages of development, but still use the basic ideas such as trade-off analysis, value chains and systems theory together with their associated techniques.

Logistics is the management of the flow of goods, information and other resources including energy and people, between the point of origin and the point of consumption in order to meet the requirements of consumers (frequently, and originally, military organizations). Logistics involve the integration of information, transportation, inventory, warehousing, material-handling, and packaging.

In order to solve the main problem of how to improve the effectiveness and efficiency in the logistic system, several sub-problems need to be solved step by step. Firstly, the unique features of the logistic system are going to be studied. It will provide us with a better understanding of the global logistics systems. Secondly, the parameters that can be used to evaluate the effectiveness and efficiency of the logistic system need to be selected. Thus, the potential logistic solutions could be compared with each other and the improvement of potential solutions could be measured as well. Thirdly, it is necessary to make case studies on mapping how the inbound logistic system looks like in practice, which will promise the practicability of this study.

LABORATORY CLASSES CONTENT

The cycle of laboratory classes on Logistics course is designed to strengthen students' formation of managerial mindset, skills, organization of logistics systems and effective management of the enterprise in the conditions of uncertainty and risk. Most suitable for this are the active forms of training and the computer simulation method.

Using active forms of learning at the laboratory classes on Logistics course allows students to consolidate their theoretical knowledge into practice, to demonstrate the interdisciplinary relationship between the courses they are studying at the university. Students learn to use different methods of analyzing and forecasting of the enterprise logistics system in the changing environment, to identify the benefits for the enterprise and to choose methods of competition, to manage limited resources of the enterprise. So, the skills acquired by students during the laboratory classes will be needed them in their future professional activity.

Labs are very demonstrable and help students to better perceive logistical processes. During the labs, students are training to manage the logistical processes and flows of the enterprise. Each week, students attended a lab classes that are 4 hours in length.

The main goals for the lab classes of Logistics course:

1. Master's students will conduct guided inquiry on the tasks that reflect logistics practice in the context of supply chain management.
2. Master's students will analyze data and propose justifiable conclusions.
3. Master's students will conduct elements of scientific research both independently and collaboratively.
4. Labs will stimulate Master's student's interest in logistics research and encourage participation in research endeavors.
5. Master's students will develop critical thinking skills in logistics that can be transfer to other economic experience.
6. Master's students will experience the successes and failures of lab classes.
7. Master's students will experience the successes and challenges of collaborative research.
8. Master's students will discuss results of laboratory classes.

The students must be prepared for each lab. They must to study the lab topic by using lecture notes and required readings in special sources. Student can control his independent work himself by the questions for self-control in

the Guidelines. If a student is not able to answer the questions himself, he should contact the course instructor during the consultations.

It is necessary to arrive on labs in time. At the beginning of the lab, a brief control of students' knowledge is conducted. The results of the control are taken into account in the lab report assessment.

Before the lab starts, students need to listen carefully to the explanations of the instructor and carefully read the description of the lab. In most lab classes, students will have a lab manual that contains background for the lab and directions of the lab procedure. Also there can be handouts or other materials students have access to. Each stage of laboratory work should be noted in drafts that allow the instructor to assess the students' activity.

The lab report must be prepared according to the guidelines. Reports are protected by student in the next laboratory class.

The rules of evaluating student's lab report are explained in these guidelines. The assessment of the laboratory classes is taken into account in general assessment of the Logistics course.

Laboratory classes comprehend all units of the course. For each lab the students will have an exercise that consists of a problem or series of problems. Its purpose is to practice and assess the understanding of the course topics that were studied in lectures and workshops. The labs can be done individually or by groups of two students.

Unit 1. Introduction to Logistics and Supply Chain Management

Lab 1. Logistics Enterprise System (2 academic hours)

The purpose of the laboratory class is providing an opportunity to apply economical and management knowledge to investigation of logistics enterprise system and logistics costs.

Lab content:

1. Determination of the logistics total cost for high-tech enterprises.
2. The calculation of the logistics system efficiency.
3. Analysis of the main results of laboratory class.
4. Writing a lab report.

Recommendations for students.

Carefully read the description of the lab. After that answer the questions, please:

1. What kinds of logistics cost do exist in the supply chain?
2. What are the ways to optimize logistics cost?

3. What budgeting methods do exist in the logistics system?
4. How do you assess the efficiency of the logistics system?

Student's task for laboratory class:

Exercise 1.

Electricity is classified as a variable expense in a flexible budget. The master budget amount for electricity at the master budget volume of activity is \$20000. If actual volume is 20 percent higher than the master budget volume, calculate the flexible budget amount.

Answer: \$24000.

Exercise 2.

Supplies expense was \$40000 last year. Current plans of budget are increase by 8 percent, but it is expected that the cost of supplies will increase by 10 percent. What should be next year's budget?

Answer: \$47520.

Required Readings: 1, 2, 3, 7, 9, 11, 13, 14, 20.

Unit 2. Logistics Management and Organization

Lab 2. Manufacturing logistics (2 academic hours)

The purpose of laboratory class is learning how to manage enterprise's resources and costs for its break-even production.

Lab content:

1. Location Evaluation Methods: factor rating technique
2. Cost-Profit-Volume or Break-Even Analysis. Factor Rating Method.
3. Center of Gravity Method of Plant Location.
4. Analysis of the main results of laboratory class.
5. Writing a lab report.

Recommendations for students.

Carefully read the description of the lab. After that answer the questions, please:

1. What is the Location Evaluation Method?
2. What does the total cost of the enterprise include in?
3. In which cases does the gravity method of plant location apply?

Student's task for laboratory class:

Exercise 1.

There is an electricity cost at the oil enterprise. One part of cost is a constant (fixed), and it includes expenses for maintenance of the territory and some facilities, but another part is a variable cost. It includes the cost for production activity.

Using data of the enterprise work for six months (*Table 1*), allocate fixed and variable cost from the total electricity cost:

- using the maximum and minimum point method;
- using the graphical method.

Table 1.

Enterprise's Cost

№	January		February		March		April		May		June	
	Q	TC	Q	TC	Q	TC	Q	TC	Q	TC	Q	TC
1	16	2014	36	3034	16	1114	16	4214	16	5114	16	6314
2	17	2060	37	3060	17	1161	17	4262	17	5161	17	6363
3	19	2040	39	3040	19	1141	19	4242	19	5141	19	6343
4	22	2034	33	3034	11	1134	44	4234	55	5134	66	6334
5	24	2078	34	3078	14	1178	44	4278	54	5178	64	6378
6	25	2056	35	3056	15	1156	45	4256	55	5156	65	6356
7	26	2045	36	3045	16	1145	46	4245	56	5145	66	6345
8	28	2012	38	3033	18	1111	48	4214	58	5115	68	6316
9	30	2042	30	3043	10	1141	40	4244	50	5145	70	6346
10	32	2051	33	3053	11	1151	44	4251	55	5151	76	6351

Cost-Profit-Volume Analysis steps:

1. Determine the fixed and variable cost for each location.
2. Plot the total-cost lines for all location alternatives on the same graph.
3. Determine which location will have the lowest total cost for the expected level of output. Alternatively, determine which location will have the highest profit.

Exercise 2.

The manufacturing company plans to produce new products. The forecasted annual demand is 600 units. Fixed cost is \$12000 in year. The variable cost per unit of product is \$42. Analysis of competitive companies that produce similar products showed that the average level of selling prices is \$67 for a unit. It is necessary to determine the "break-even point" in natural and value terms.

Required Readings: 1, 3, 7, 9, 11, 12, 14, 16, 17, 18, 19, 20.

Lab 3. Distribution System (2 academic hours)

The purpose of laboratory class is improving student's skills in collecting, analyzing, interpreting and presenting data of distribution system.

Lab content:

1. Defining market boundaries
2. Analysis of the main results of laboratory class.
3. Writing a lab report.

Recommendations for students.

Carefully read the description of the lab. After that answer the questions, please:

1. What is the Checklists Method in the distribution network?
2. In what cases is it advisable to use the analogy method in the distribution?
3. Could you formulate the Reilly's Law? What is the 'turning point' in the distribution network?

Student's task for laboratory class:

Two enterprises, enterprise X and enterprise Y, produce the same type of products. So, they are the main competitors in the market of the same region. Also they use the same distributor to distribute their products.

For increasing of distributor's attention and ensuring a stable sales volume, both companies are actively doing business with the distributor. However, it is necessary not only to offer the products, but also to fulfill in strict accordance agreement conditions.

The contract of the enterprise X and the contract of the enterprise Y provide equal relations with the distributor: the delivery of the products must be made every 15 days, the total delivery volume is 5000 tons. The delivery delay time should not exceed two days.

In fact, during the last month the enterprises had the following business results (*Table 2*).

Table 2

Business Results of Enterprises

Enterprises 1			Enterprise 2		
Delivery period	Scope of delivery, thousand tons	Delivery delay, days	Delivery period	Scope of delivery, thousand tons	Delivery delay, days
1	5	2	1	4,1	3
2	3,2	3	2	5,9	2

Enterprises 1			Enterprise 2		
Delivery period	Scope of delivery, thousand tons	Delivery delay, days	Delivery period	Scope of delivery, thousand tons	Delivery delay, days
3	6,8	2	3	5	3

Analyze rhythm and uniformity of supply of enterprises, and estimate the average delay in deliveries for the periods. Compare the performance of enterprises with the terms of the supply contract. What enterprise does have the best situation? What bottlenecks in the sales system do they need to pay attention to?

Required Readings: 1, 2, 3, 4, 5, 8, 10, 12, 14, 16, 17, 18, 20.

Lab 4. Procurement and supply (2 academic hours)

The purpose of laboratory class is to develop students' skills in choosing of supplier and managing procurement.

Lab content:

1. Provider Choice
2. "Make-or-buy decision"
3. Analysis of the main results of laboratory class.
4. Writing a lab report.

Recommendations for students.

Carefully read the description of the lab. After that answer the questions, please:

1. What is the problem *MOB* - "*Make-or-Buy*"?
2. What is the *TCO* model ("*Total Cost of Operation*")?
3. What are the assessment criteria of the suppliers' effectiveness?

Student's task for laboratory class:

Company X has expanded the range of its products and has received a very profitable and responsible order for the medicament delivery to the aerospace corporation. The timing of the contract was very stringent.

The company X has already worked with long-term supply partners of raw materials - companies A and B, which expressed their willingness to participate in the project, but it was a new direction for them. In addition, very good price conditions were offered by a large company C, which can ensure the company's annual demand for raw materials by only one supply. So, Company X has chosen the supplier of raw materials for this project. What supplier has the company X chosen?

The following parameters were used to solve the case:

- the assessment criteria for selecting a supplier (*Table 3*);
- five-score evaluation of the value (weight) of the supplier selection criteria (from 0 to 4);
- declared quality of the goods from all three suppliers is the same;
- prices and terms of delivery (*Table 4*);
- assessment criteria of the suppliers' activities and their results of the first year (*Tables 5*).

Table 3

Criteria of the supplier choosing

Assessment criteria	The weight of the criteria
Reliability of delivery	0,3
Cost of raw materials	0,25
Declared quality of raw materials	0,15
Terms of payment and the necessity for storage of raw materials	0,15
The possibility of unscheduled deliveries and corrective actions	0,1
The financial conditions and the dynamics of the relationship with the buyer	0,05

Table 4

Prices and terms of delivery of raw materials

Indicator	Company A	Company B	Company C
The price for one ton of raw materials, \$	20	20	25
Distance from X to the supplier's warehouse, km	150	180	200
Transportation tariff for 1 km, \$/km	5	7	7
Delivery schedule	Quarterly, the batches of 250 tons	Quarterly, the batches of 250 tons	Once a year, a batch of 1000 tons
Form of delivery	The cargo is palletized	Boxes	The cargo is palletized
Unloading cost, \$ per tonn	2	3	2

Indicator	Company A	Company B	Company C
Time for unloading, hours	6	8	22

Table 5

Scores of the first year work of suppliers (expert's evaluation)

Indicator	Company A				Company B				Company C
	Quarter				Quarter				Quarter
	1	2	3	4	1	2	3	4	1
Reliability of delivery	250	250	250	250	250	250	250	250	1000
Cost of raw materials	3	3	4	4	3	3	4	4	4
Declared quality of raw materials	4	4	3	4	4	4	4	3	4
Terms of payment and the necessity for storage of raw materials	4	4	4	4	3	4	4	4	2
The possibility of unscheduled deliveries and corrective actions	3	4	3	3	4	3	2	4	4
The financial conditions and the dynamics of the relationship with the buyer	4	3	4	4	3	4	3	3	4

The difficulties in choosing a supplier are often connecting with the uncertainty conditions. The result depends on the influence of various factors on the selecting criteria and their evaluation by the experts. At the same time, during the business, the rating of suppliers may change or work with several suppliers can be started.

Criteria 1 “Reliability of delivery”. The rating of company C, which carries out the total volume of delivery, is higher than the rating of companies A and B.

Criteria 2 “Cost of raw materials”. It is important that the calculation of the raw materials cost depends on not only the purchase price, but the terms of delivery, the cost of transportation (if the transport is carried out by the buyer) and the cargo handling.

Criteria 3 “Declared quality of raw materials”. The rating by this criteria is approximately the same for all suppliers.

Criteria 4 “Terms of payment and the necessity for storage of raw materials”. The supply of raw materials requires adequate payment and storage cost. The rating of the organizations A and B is higher than the rating of the company C.

Criteria 5 “The possibility of unscheduled deliveries and corrective actions”. The conditions of the first year business can require adjustments in the quantity and quality of the supplied raw materials.

Criteria 6 “The financial conditions and the dynamics of the relationship with the buyer”. Company C can be much larger and more financially sustainable than companies A and B. But company X already has working experience with companies A and B and it can equalize the evaluation of all three organizations by this criteria.

Required Readings: 1, 2, 3, 7, 8, 10, 11, 16, 17, 18, 19, 20.

Unit 3. Logistics Operations

Lab 5. Transportation Systems (2 academic hours)

The purpose of laboratory class is to develop student’s ability to solve the transportation problem by different methods.

Lab content:

1. Modeling the transportation problem
2. Solution of the Transportation Problem by the North-West Corner Method
3. Solution of the Transportation Problem by the Least-Cost Method
4. Solving the transportation problem with Excel Solver
5. Analysis of the main results of laboratory class.
6. Writing a lab report.

Recommendations for students.

Carefully read the description of the lab. After that answer the questions, please:

1. What does "closed model of the transportation problem" mean?
2. What are the main methods for the transport problem solving?

Student's task for laboratory class:

The data for the Transportation Problem are given in *Table 6*.

Table 6

Consumer	X1	X2	X3	X4	Supply
Supplier					
Y1	1	2	3	4	60
Y2	4	3	2	0	80
Y3	0	2	2	1	100
Demand	40	60	80	60	240

Please, solve this problem by methods you know.

Required Readings: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 16, 18, 19, 20.

Lab 6. Transportation Systems (2 academic hours)

The purpose of laboratory class is to develop student's skills in applying a range of practical methods and approaches to transportation problems solution.

Lab content:

1. Logistics Problems Solution by Using Graph Theory and Networks.
2. Solve shortest path problem in graph.
3. Maximum Flow in the Network
4. Analysis of the main results of laboratory class.
5. Writing a lab report.

Recommendations for students.

Carefully read the description of the lab. After that answer the questions, please:

1. What is a dummy user and when it is injected into the transport task?
2. What kind of problems can be solved by graph theory?
3. What are the rules for constructing network diagrams?

Student's task for laboratory class:

There are three enterprises that can supply components to four computer manufactures. The distance data between suppliers and consumers is indicated in *Table 7*.

Table 7

The distance data between suppliers and consumers

Suppliers	Consumers (computer manufactures)	

	Firm 1	Firm 2	Firm 3	Firm 4	Volume of Production
Enterprise 1	80	120	270	90	70
Enterprise 2	130	180	250	110	80
Enterprise 3	210	170	140	150	150
Demand	50	90	100	60	-

A transport tariff is 100 dollars per ton km. What transportation volume will provide the minimal cost?

Required Readings: 1, 2, 3, 6, 7, 8, 9, 10, 11.

Lab 7. Warehouse Management (2 academic hours)

The purpose of laboratory class is to develop student's ability to choose the criteria for warehouse location and assess warehouse's effectiveness.

Lab content:

1. A Comparison of Heuristic Method for Service Facility Locations
2. Responsibility assignment matrix.
4. Analysis of the main results of laboratory class.
5. Writing a lab report.

Recommendations for students.

Carefully read the description of the lab. After that answer the questions, please:

1. What are the criteria for warehouse location?
2. In which cases the Heuristic Methods can be used?
3. What are the issues of the warehouse optimization?

Student's task for laboratory class:

A trading company is considered a major intermediary in the wholesale market. In order to enter a new sales market, company's management decided to open a branch in the neighboring region. It is necessary to determine the feasibility of building company's warehouse, if the projected annual turnover of the warehouse is 10000 tons, the length of the stock in the warehouse is 29 days. It is planned to invest \$1500000 for the warehouse building. The fixed cost of the warehouse is \$750000. The cargo operation cost of 1 ton is \$1 per a day.

Analysis of the regional warehouse services market showed that the average cost of using 1 square meter of the warehouse is \$3,9 per a day. The number of working days of the warehouse is 255. The normative payback period of capital investments is 6 years.

Does the company need to build its warehouse?

Required Readings: 1, 3, 4, 5, 6, 7, 8, 11, 12, 13, 18, 20.

Unit 4. Logistics Administration and Integration in the Supply Chain

Lab 8. Inventory management and the supply chains (2 academic hours)

The purpose of laboratory class is to learn to apply the ABC analysis to the data of inventory management and to improve student's skills in analyzing, interpreting and presenting its results.

Lab content:

1. Economic Order Quantity: Determining How Much to Order
2. Stochastic Periodic-Review Models
3. Analysis of the main results of laboratory class.
4. Writing a lab report.

Recommendations for students.

Carefully read the description of the lab. After that answer the questions, please:

1. What the statistical methods can be used for the calculating of target and safety stock?
2. What is the production natural decline?
3. How the parameters of inventory control system with a fixed order can be calculated?
4. What is the ABC method?
5. What is the XYZ method?
6. How can we use ABC- XYZ matrix for inventory managing?

Student's task for laboratory class:

A high-tech company designs and develops electronics, computer software and personal computers. In the assembling of its smart-phone, the main items can be grouped as followed (*Table 8*)

Table 8

The main items of high-tech company

№	Item	Consumption, <i>pieces</i>	Unit value, \$/ <i>pieces</i>
1	LED display	6000	20

№	Item	Consumption, <i>pieces</i>	Unit value, \$/ <i>pieces</i>
2	OLED display	40000	50
3	Retina HD display	10000	48
4	Memory 16GB	14000	10
5	Memory 32GB	40000	13
6	Memory 64GB	9000	16
7	Camera 5MP	45000	16
8	Camera 8MP	15000	20
9	Connectivity system 1	18000	5
10	Connectivity system 2	36000	10
11	Core electronic dual	5000	40
12	Core electronic quad	50000	60
13	Core electronic multi	7000	60
14	Battery lithium ion	40000	10
15	Battery lithium polymer	14000	20
16	Sensors gyro	18000	3
17	Sensors ambient light	36000	5
18	Mechanical component version A	9000	20
19	Mechanical component version B	54000	18
20	Other electric component	70000	30

Considering the data illustrated in the table below, classify the items into three groups in order of their performance using an ABC Analysis.

The idea of the ABC method is to distinguish the most significant objects from a set of similar objects. As a rule, such objects are few, and it is necessary to pay the main attention to them.

ABC analysis steps:

1. Formulation of the purpose of the analysis.
2. Identification of control objects analyzed by the ABC method.
3. Identification of the object's feature that will be the basis for the classification of objects.
4. Evaluation of the objects according to the distinguished classification feature.

5. Grouping of the objects according to the value decrease.
6. Construction of the ABC curve.
7. Separation of the objects into three groups: group A, group B and group C.

Required Readings: 1, 2, 3, 6, 7, 8, 10, 11, 12, 13, 15, 17.

Lab 9. Logistics Security Management (2 academic hours)

The purpose of laboratory class is to develop student's ability to assess risks in logistics by the statistical methods.

Lab content:

1. Assessment of logistics risks by the statistical methods. The payoff matrix.
2. Calculation of the risk.
3. Analysis of the main results of laboratory class.
4. Writing a lab report.

Recommendations for students.

Carefully read the description of the lab. After that answer the questions, please:

1. What kinds of risks do you know?
2. What methods of risk assessment are used in logistics?
3. What rules for the risk curve constructing do exist?
4. What is the *CCRS* map (*Composite Common Risk Segment map*) and the "probability - loss" matrix?

Student's task for laboratory class:

The company's logistics service conducted a research of raw material market. As a result, company selected three the most attractive suppliers. The suppliers were evaluated by seven criteria on a 10-score scale:

- I - timeliness of deliveries;
- II - quality of the delivered goods;
- III - terms of payment (cash, bank transfer);
- IV - financial condition of the supplier;
- V - price;
- VI - safety of cargo;
- VII - the possibility of unscheduled deliveries.

The results of the selection and the expert criteria are presented in *Table 9*.

Table 9

Results of expert selection of suppliers

Criteria	Weight of the criteria	Provider					
		A	B	C	D	E	F
I -timeliness of deliveries	0,1	4	7	10	6	8	9
II - quality of the delivered goods	0,2	6	5	6	9	10	8
III - terms of payment (cash, bank transfer)	0,2	3	6	7	3	8	9
IV - financial condition of the supplier;	0,1	6	8	7	9	10	9
V - price	0,2	7	5	8	10	9	8
VI - safety of cargo	0,15	3	8	4	9	7	7
VII - the possibility of unscheduled deliveries	0,15	5	7	9	10	5	7

Students need to decide with what supplier to enter into a contract.

Required Readings: 1, 2, 3, 4, 5, 6, 8, 10, 11, 14, 16, 17, 19, 20.

LAB REPORT CONTENT

General Comments: The students are advised to note the following rules regarding the lab report.

The single most important requirement for the laboratory report is clarity. If students are using a word processor for their lab report, then they must use the spelling and grammar checkers. The grammar check can be anywhere because often sentences are wordy and complex. In general, passive sentences are less understandable. However, grammar check will not assess clarity, and it will ignore simple errors.

Lab Report Structure:

1. Cover Sheet.

The lab report should include a title page (cover sheet) as that presented in appendix 1, with all of the appropriate information. This page has the assigned lab section, the title of the lab, student's name, the date that the lab was performed and the course instructor's name.

2. Abstract.

The purpose of an abstract is to help a reader decide if this paper is interesting for him/her or not. The abstract should be brief. Generally, the abstract should answer the following questions:

- What is the objective of the lab?
- What actions and calculations are performed to achieve the objective?
- What are the main results of the lab achieved?
- What conclusions can be made from these results?

The abstract should never be more than one page long and should not include any references to the body of the report.

3. Objective and Introduction.

The objective should answer the question: What is the lab objective designed to determine? Please, state the objective clearly in a complete sentence. A few explanatory sentences may be included, if needed.

The introduction must start in a separate paragraph. It provides explanation of the logistics problem. It explains the significance as well as any significant background information of the problem.

4. Data.

For each lab manual has one or more data sheets for recording raw data, as well as, intermediate and final data values. The values that students record on their data sheet can be:

- units (such as kg for kilograms, km for kilometers);

- reasonable uncertainty and risk estimates for logistics procedures and supply chain steps
- significant logistics digits;
- statistics error for calculated quantities.

5. *Graphs.*

Students must follow the lab guidelines for all graphs. It is allowed to perform graphs and schemes in manual for lab report.

6. *Calculations.*

Students must show calculations in a neat and orderly outline form. Students include in the lab report a brief description of the calculation, the equation, numbers from their data substituted into the equation and the result. They do not include the intermediate steps. Numbers in the sample calculations must agree with what they recorded in their data sheet. For calculations repeated many times, students only include one sample calculation. Their answers should have the proper number of significant figures and units. (It is not necessary to show the calculation for obtaining an average). Typing the equation into the lab report is also required. Students can use the equation editor in Microsoft Word or they can do it in manual.

7. *Results.*

Students should summarize their results in the introductory sentence. They must relate their results to their objective. It is necessary to present the results in the easiest way for the course instructor to understand: graphs, tables, figures, etc. Spreadsheets are often an ideal tool for organizing the data, analyzing the data, and generating graphs and tables. All tables and figures should be accompanied by comments in the text of report. It is important to use a numbering system for identification of each one. All figures and tables must have numbers and captions. While the table captions should be placed over the table, figure captions should be placed below the figure.

8. *Discussion of Results.*

This is the most important part of the lab report. It is devoted to analyzing the data. Students should explain the results of the lab, comment on the results they obtained, compare obtained results with expected results, give probable reasons for discrepancies from the correct results, answer post-lab questions and solve any problems that may have been presented.

9. *Conclusions*

Students should state their discoveries, judgments and opinions from the results of the lab. Make recommendations for further study. Suggest ways to improve the results if it is possible.

Endnotes. The report should not be a big production. It should not take hours to write. The lab report objective is to write down the significant details of the lab topic, the analysis of the data and results.

No student should copy data and results from anyone who is not his or her lab partner. Students may discuss the results with their lab partner and other students, but the lab report that they submit must be their own work. Lab reports are subject to all the rules governing academic honesty. Photocopies of any parts of the lab report are not permissible.

ASSESSMENT TOOLS

Laboratory classes contribute to the development of three student competencies:

- ability to think critically, analyze and synthesize information (CC-1, Cultural Competency-1);
- ability to conduct individual research; to prove relevance and significance of research (GPC-1, General Professional Competency -3);
- ability to conduct research and manage business processes using qualitative and quantitative methods; to develop analytical reports (PC-4, Professional Competency-4).

So, the main purpose of assessing of the students activity during laboratory classes and their lab reports is to examine the degree of student's competencies development according to the Federal Educational Standard.

These competencies imply a number of learning outcomes that can be demonstrated by students during the preparation of the lab report.

Learning outcomes that can be assessed using lab report include:

- technical skills in using computer software;
- an understanding of logistics procedures and scientific methods;
- the skills of scientific enquiry and problem-solving in logistics;
- the complementary skills of collaborative learning and teamwork in laboratory settings;
- understanding, and being prepared for, future possible roles in laboratory-based work.

Laboratory reports are prepared on completion of the lab task. They demonstrate students' calculations, interpretation and reflection abilities, and course instructor can infer from them the knowledge and skills developed through laboratory classes. Laboratory reports also involve a lot of work for the students and course instructor, sometimes entailing delays between the student's submission of the report and the return of feedback and grades.

Sometimes students report on methods they did not implement, or results they did not obtain. Course instructor should address ethical issues as a central part of lab report. For example, students need to add a personal reflection on any logistical problems they faced in carrying out their laboratory work and preparing their report.

The main criteria used by the course instructor to assess student's lab report are given in *Table 10*.

Table 10

Lab Report Assessment Criteria

	Excellent	Good	Adequate	Inadequate
Header Name, Title of Experiment, Date	Complete and written with care.	Complete, but not written with care.	Complete, but written with mistakes.	Not complete and/or not written with care.
Purpose	Purpose clearly explains what was to be discovered.	Purpose generally explains what was to be discovered.	Purpose is not clearly focused on what was to be discovered.	Sentence present but does not explain purpose.
Answer Key	An answer key is provided for both pre-lab questions and post-lab questions.	An answer key is provided for both pre-lab questions and post-lab questions.	An answer key is provided for only one of the question sets: pre-lab questions or post-lab questions.	An answer key is provided for only some pre-lab questions or post-lab questions.
Data/Observations	Well written qualitative sentences with no inferences. Quantitative data chart, graph or picture contain proper units and labels are present. Calculations clearly shown, if applicable.	Well written qualitative sentences with no inferences. Quantitative data chart, graph or picture lacks proper units or labels. Some calculations clearly shown.	Qualitative sentences contain no inferences. Quantitative data chart, graph or picture lacks proper units or labels. Some calculations are absent or not clearly shown.	Qualitative sentences contain inferences. Qualitative data chart, graph or picture is incomplete or indiscernible.

	Excellent	Good	Adequate	Inadequate
Analysis of Data	Sentences provide clear explanation for the meaning of your data, if applicable. Specific references are made to the data.	Sentences provide general explanation for the meaning of your data, if applicable. Some specific references are made to the data.	Sentences provide an explanation for the meaning of your data, if applicable. References are made to the data.	Sentences are present but provide no clear explanation of data or do not make specific references to the data.
Conclusion/ Results	The categories are well reasoned and show critical thinking with deep analysis of the concepts being explored.	Only some categories are well reasoned and show critical thinking with analysis of the concepts being explored.	The categories are reasoned and show some critical thinking with analysis of the concepts being explored. Some errors present	The categories are present but demonstrate a surface level understanding of the concepts being explored
Creativity	The lab report has innovative designs and original thoughts. Provides distinction from the lab examples from websites and other training websites.	The lab has some innovative designs while possessing a few overlapping images of lab examples from websites and other training websites.	Lacks original creativity. More than 50% of the lab ideas were adapted from the websites or other training websites.	The lab examples were very similar to the lab examples from websites.

	Excellent	Good	Adequate	Inadequate
Grammars and Errors	Contains no grammatical errors.	Contains only a few minor errors but no major errors.	Contains several errors to include a major error.	Contains a few major errors.

ATTENDANCE POLICY

Attendance is a key factor in academic success. Any absence, regardless of the reason, will prevent the student from getting the full benefit of the course. Therefore, students should recognize the advantages of regular and punctual class attendance; accept it as a personal responsibility. Absences are controlled by institution direction. The number of absences for whatever reason is taken into account in the final grade.

The instructor has the right does not to admit the late student to the laboratory class.

In the case of missing a lab the student must take additional classes of laboratory training and submit lab report. Additional classes are paid by the student in accordance with the standards established by the institute administration.

REQUIRED COURSE MATERIALS

Required Readings

1. Blanchard D. Supply chain management: best practices. Wiley, 2010. 302 p. ISBN: 0470531886.
2. Clausen U., Hompel M.T., Klumpp M. (Eds.) Efficiency and Logistics Springer, 2012. 305 p. 54. ISBN: 978-3-6423-2838-1.
3. Crandall R.E., Crandall W.R., Chen C.C. Principles of Supply Chain Management. 2nd ed. CRC Press, 2015. 704 p. ISBN: 978-1-4822-1205-1.
4. Gleissner H., Femerling J.C. Logistics: Basics - Exercises - Case Studies. Springer, 2014. 311 p. ISBN: 978-3-3190-1769-3.
5. Myerson, Paul. Lean Supply Chain and Logistics Management. McGraw Hill Publisher, 2012. 270 p. ISBN: 978-0-07-176626-5.
6. Waters D. Logistics: An Introduction to Supply Chain Management. Palgrave Macmillan, 2003, 364 pages ISBN: 978-0-3339-6369-2.

Further Readings

7. Anbuudayasankar S.P., Ganesh K., Mohapatra S. Models for Practical Routing Problems in Logistics: Design and Practices. Springer International Publishing, Switzerland, 2014. 229 p. ISBN 978-3-3190-5034-8.
8. Baker Peter, Croucher Phil, Rushton Alan. The Handbook of Logistics and Distribution Management. 4 ed. Kogan Page, 2010. 664p. ISBN: 978-0-7494-5714-3.
9. Bookbinder J.H. (Ed.) Handbook of Global Logistics: Transportation in International Supply Chains. Springer, 2012. 553 p. ISBN: 978-1-4419-6132-7.
10. Bowersox, D.J., Closs, David J, Cooper, Bixby, Bowersox, J.C., Supply Chain Logistics Management. 4th ed. McGraw Hill, New York, 2013. ISBN: 978-0-07-802405-4.
11. Bowersox, D.J., Closs, David J, Cooper, Bixby, Bowersox, J.C., Supply Chain Logistics Management. 4th ed. McGraw Hill, New York, 2013. ISBN: 13: 978-0-07-802405-4.
12. Bozarth C., Handfield R.B. Introduction to Operations and Supply Chain Management. 2nd ed. Prentice Hall, 2007. 600 p. ISBN: 978-0-1317-9103-9.
13. Chopra S. and Meindl P., Supply Chain Management – Strategy, Planning, and Operation. 3rd ed. Prentice Hall, Pearson, 2008. 552 p. ISBN: 978-0-1320-8608-0.

14. Jacobs F.R et al. Manufacturing Planning and Control for Supply Chain Management. McGraw-Hill Professional, 2011. 576 p. ISBN: 978-0-0717-5031-8.

15. Johnson, Leeders, Flynn, Purchasing and Supply Chain Management. 14nd ed. McGraw-Hill, New York, 2011. ISBN-978-0-07-337789-6,

16. Kurbel K.E. Enterprise Resource Planning and Supply Chain Management. Springer, 2013. 359 p. ISBN 978-3-6423-1572-5.

17. Liang Z., Chaovalitwongse W.A., Shi L. Supply Chain Management and Logistics: Innovative Strategies and Practical Solutions. 2nd ed. CRC Press, 2016. 38 p. ISBN: 978-1-4665-7788-6.

18. Renko S. (Ed.) Supply Chain Management - New Perspectives. InTech, 2011. 784 p. ISBN: 978-9-5330-7633-1.

19. Waters D. Logistics: An Introduction to Supply Chain Management. Palgrave Macmillan, 2003. 364 p. ISBN: 978-0-3339-6369-2.

20. Wisner J.D., Tan K.-C., Leong G.K. Principles of Supply Chain Management: A Balanced Approach. 3rd ed. Cengage, 2012. 593 p. ISBN: 978-0-5384-7546-4.

Lab Report Cover Sheet (Title Page)

MINISTRY OF EDUCATION AND SCIENCE
OF THE RUSSIAN FEDERATION

SAMARA NATIONAL RESEARCH UNIVERSITY

Institute of Economics and Management

Department of Management

Logistics

Lab Report № ____

Title of Lab: « _____ »

Date of Performance: _____

Master's Student's Name: _____

Course Instructor's Name: _____

Date of Submission _____

Samara
20_ (year)

Методические материалы

ЛОГИСТИКА
МЕТОДИЧЕСКИЕ
УКАЗАНИЯ
К ЛАБОРАТОРНЫМ
РАБОТАМ

GUIDELINES
FOR LABORATORY
CLASSES IN LOGISTICS

Составитель *Ефимова Екатерина Андреевна*

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