



National Research University Higher School of Economics
Programme of the course «Supply Chain diagnostics» for master degree students
(educational direction 38.04.02, master program «Strategic management of logistics»)

Government of the Russian Federation

Federal State Autonomous Educational Institution of the Higher Professional Education "National Research University "Higher School of Economics"

Faculty of Logistics

Programme of the course

SUPPLY CHAIN DIAGNOSTICS

For the direction 38.04.02 «Management» of the master degree students education,
Master program “Strategic management of logistics”

Author of the programme:

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Course name: “Supply Chain Diagnostics”

1. Abstract:

The most interesting and challenging part of logisticians' work include analysis of current logistic business processes and finding reserves to improve operational efficiency. Successful supply chain optimization and achieved savings always assume the previous step of clearly structured and well-managed diagnostics.

Supply Chain diagnostics is a course about structural approach for analysis and investigation of operational efficiency in a number of areas within supply chain management. Classes will cover the following key SCM areas:

- Planning
- Procurement
- Manufacturing
- Distribution

Approach for diagnostics within each area will include general sequence of steps, key aspects of SC efficiency to investigate, list of questions to address, examples of benchmarks and good practices to consider when comparing the current and the target states of supply chain and defining major deviations. Students also will be introduced to existent tools and methods for collection, processing and visualization of raw data and final results / conclusions of diagnostics.

Course will help students to build up professional look on supply chain functional areas, develop skills for express analysis and problem identification, improve overall supply chain competence.

2. Course objectives

Having taken the course a student must:

- understand goals, general approach and expected results from of supply chain diagnostics; know differences between preventive and symptomatic diagnostics
- recognize common tools of SC diagnostics:
 - (Capability) Maturity models – tool for assessment of maturity level for SC business processes in the observed company vs existing market or cross-industry good practices and recommendations
 - Competitive benchmarking – leader-based or competitor-based comparison based on a list of SC metrics used to measure the efficiency of supply chain performance
 - Supply Chain data analysis and modeling – tools and methods to model existing SC procedures in order to estimate potential savings or the efficiency of proposed improvements
- Recognize existing concepts of SC diagnostics, be able to use and adopt SCOR-based framework (concept) for SC diagnostics under concrete terms. Existing concepts of SC diagnostics include:
 - “Quick Scan” methodology
 - Foggin’ Supply Chain Diagnostic Tool”



- “Hierarchy of Supply Chain metrics
- Supply Chain value assessment models / diagnostic methods proposed by a number of consulting companies (Deloitte, Accenture, etc)
- Supply Chain Reference Model (SCOR 5.0)
- know key performance indicators, major points of analysis and approaches for express diagnostics for main SCOR functional areas: “Planning”, “Sourcing”, “Manufacturing”, “Distribution”. All KPIs’ proposed to use within measurement and benchmarking can be divided in three groups:
 - SC KPIs’ for cost management and control
 - SC KPIs’ for service level management and improvement
 - SC KPIs’ for supply chain responsiveness (incl. SC flexibility)

Student has to know how to calculate KPIs’, which data is needed for calculation and analysis, which findings can be made.

- know sources and ways to collect information for SC benchmarking and good practice analysis.

3. Syllabus

Theme	Classes (h)	Independent work (h)
“Introduction in methodology”	4	2
“Diagnostics in planning”	5	2
“Diagnostics in procurement”	5	2
“Diagnostics in manufacturing”	5	2
“Diagnostics in distribution”	5	2
Course control	2	
Total	26	10

4. Theme description

Theme 1: “Introduction in methodology”

Theme content (brief)

Part 1:

- Definition of Supply Chain Diagnostics
- Goals and projected results
- Place of SC Diagnostics in various SCM projects

Part 2:

- Difference between preventive and symptomatic diagnostics
- 5-step approach to SC diagnostics



- Standard tools and methods of SC diagnostics

Part 3:

- The value of frameworks
- Existing frameworks for SC Diagnostics
- Proposed framework (directions and levels of analysis) for corporate SC diagnostics based on Supply Chain operations reference model (SCOR)
- Examples of using the framework

Theme outline:

Supply Chain Management. Supply Chain Diagnostics. Internal audit. Supply Chain Due Diligence.

Preventive and symptomatic diagnostics. Business process maturity assessment. Maturity model. Gap analysis. Data template. Supply Chain metric. Benchmarking. Supply Chain data analysis. Investigation and prioritization of hypothesis for performance improvement. Questionnaires, process maps and interviews as ways to collect information for maturity assessment. Types of questions within maturity assessment. Radar charts. Four business process maturity levels: lagging, developing, performing, leading. Approach to Supply Chain benchmarking. 6 types of benchmarking. Sources of benchmarking. Supply Chain key performance indicators. Supply Chain modeling. Five main types of Supply Chain data. Object-event simulation of logistic bottlenecks. Gaps identification. Two main criteria for prioritization of recommendations: business impact and easy of implementation. Prioritization matrix. Waves of recommendations. “Low hanging fruits”. Quick wins. Elevator test.

Framework for diagnostics. Mnemonics. Areas and levels of analysis. The existing techniques of SC Diagnostics. The Depot Service Index. Hierarchy of Supply Chain metrics (by Debra Hofman). Cash-to-Cash cycle. Days payable outstanding. Days sales outstanding Root cause analysis. Supply Chain Diagnostic Tool (by J.H. Foggin). Customer value determination method. Means-ends hierarchies. Supply Chain Problem Symptoms. Quick Scan Audit Methodology (QSAM) (by M.M. Naim). Supply Chain optimization modelling architecture (SCOMA) framework. Supply Chain Operations Reference (SCOR) model. Four main areas of SC Diagnostics: Planning, Procurement, Manufacturing, Distribution. Five main levels of analysis: Strategy, Business processes, Infrastructure, Organization, Control and motivation system.

Main references/books/reading:

1. Arshinder, A., Kanda, A. and Deshmukh, S.G. (2008) ‘A framework for evaluation of coordination by contracts: a case of two-level supply chains’, Computers & Industrial Engineering, in press
2. Boone, C.A., Drake, J.R., Bohler, J.A. and Craighead, C.W. (2007) ‘Supply chain management technology: a review of empirical literature and research agenda’, Int. J. Integrated Supply Management, Vol. 3, No. 2, pp.105–124.
3. Darryl V. Landvater. World Class Production and Inventory Management // John Wiley and Sons, Inc., 2 edition, 1997
4. David Blanchard. Supply Chain Management. Best practices // John Wiley and Sons, Inc., 2010



5. David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi. *Designing and Managing the Supply Chain* // McGraw-Hill; 4 edition, 2012.
6. Debra Hofman. *The Hierarchy of Supply Chain Metrics: Diagnosing Your Supply Chain Health* // AMR Research Report (2008)
7. Glock, C.H. and Jaber, M.Y. (2013) 'An economic production quantity (EPQ) model for a customer-dominated supply chain with defective items, reworking and scrap', *Int. J. Services and Operations Management*, Vol. 14, No. 2, pp.236–251.
8. Gupta, O.K., Jantan, M. and Ndubisi, N.O. (2005) 'The moderator effect of supplier management on the relationship between supplier selection and manufacturing flexibility', *Int. J. Services and Operations Management*, Vol. 1, No. 2, pp.147–167.
9. James H. Foggin, John T. Mentzer, Carol L. Monroe, (2004), "A supply chain diagnostic tool", *International Journal of Physical Distribution & Logistics Management*, Vol. 34 Iss 10 pp. 827 – 855
10. M.M. Naim et al. *A supply chain diagnostic methodology: determining the vector of change* // *Computers and Industrial Engineering* 43 (2002)
11. Ronald H. Ballou. *Business Logistics / Supply Chain Management* // Pearson Prentice Hall, 2003.
12. R.K. Sinha, A. Subash Babu., (1998) "Quality of customer service in supply chain system: a diagnostic study", *International Journal of Quality & Reliability Management*, Vol. 15 Iss: 8/9, pp.844 – Stock, J. R. *Strategic logistics management*. McGraw-Hill/Irwin, 2001. - 872 p.
13. Waters, D. *Supply chain risk management*. New York Kogan Page, 2007. - 256 p.

Theme 2: "Diagnostics in planning"

Theme content (brief):

- KPI's in supply chain planning and inventory management
- Inventory management policies
- Supply Chain Planning & Control processes
- IT support of planning activities
- Organizational design of SC planning procedures

Case:

- Optimizing planning process for Wine distributor

Theme outline:

Demand planning. Sales and Operations planning. Distribution requirements planning. Master scheduling. Materials requirements planning. Rough cut capacity planning. Order Promising. Available-to-promise. Capable-To-Promise. Client Order Decoupling Point (CODP). Postponement. Collaborative Planning. Advanced Planning & Scheduling System Assessment. Frozen schedules. S&OP planning issues and opportunities. Check-list collaboration issues in product development and improvement. Check-list collaboration issues in order, delivery and receiving process. Determination of the cycle times of material and information flows.



Forecasting method and timeline. Relationship between the forecasts method and the demand pattern of products. Volume – Variety analysis of goods for forecast technique selection. “Brown paper” analysis. Forecast accuracy. Bias. Standard deviation of forecast error (MAD). Impacts of forecast errors

ABC-classification of inventory. Inventory Carrying Strategy. Inventory Carrying Costs. Inventory Service Level. Inventory Pareto Analysis. Inventory Gap Analysis. Inventory Item Diagnosis. Slow moving inventory. Illiquid inventory. Inventory turns. Stock days. Out-of-stock. On-stock availability

Case outline:

Sharp increase in sales volumes and significant changes in structure of distribution channels of Wine Wholesaler resulted in a number of system-wide supply chain problems. Existing business processes and supply chain configuration are not effective enough in terms of a management of material flows in the context of high growth rates and new market challenges (e.g., rapid network retail trade development). The express Supply Chain diagnostics should be done to identify root causes of low operational efficiency in new business conditions.

Case is tailored to planning diagnostics and helps to examine to verify the acquired knowledge.

Main references/books/reading:

1. Darryl V. Landvater. World Class Production and Inventory Management // John Wiley and Sons, Inc., 2 edition, 1997
2. David Blanchard. Supply Chain Management. Best practices // John Wiley and Sons, Inc., 2010
3. David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi. Designing and Managing the Supply Chain // McGraw-Hill; 4 edition, 2012
4. Jacobs, F. R. Manufacturing planning and control for supply chain management // New York McGraw-Hill, 2011. - 544 p.
5. Matthias Lutke Intrup. Advanced Planning in Fresh Food Industries - Integrating Shelf Life into Production Planning // Physica-Verlag, TU Berlin, 2005
6. Ronald H. Ballou. Business Logistics / Supply Chain Management // Pearson Prentice Hall, 2003
7. Stock, J. R. Strategic logistics management. McGraw-Hill/Irwin, 2001. - 872 p.
8. Supply chain planning // Springer, 2009. - 392 p.
9. Thomas F. Wallace and Robert A. Stahl. Sales and Operations Planning: The How-to Handbook, 3rd ed. // T.F. Wallace & Co.; 3 edition (February 1, 2008)
10. Tony Wild. Best practices in inventory management // John Wiley and Sons, Inc., 1997

Theme 3: “Diagnostics in procurement”

Theme content (brief):

- Key procurement efficiency indicators



- Spend analysis and cost savings opportunities
- Procurement business processes maturity assessment: key tips
- Procurement centralization and FTE benchmarks
- Procurement data availability and IT capability mapping

Case:

- “Green Food” company: express procurement diagnostics

Theme outline:

Procurement. Sourcing and Purchasing as the main parts of Procurement. Spend profile. Spend analysis. Spend data and spend cube dimensions. Main spend data: Price data, Volume data, Supplier reliability data and Cash-to-Cash cycle data. Sources of spend data: purchase requisitions, purchase orders, contracts, invoices, ERP system transactions. Hypothesis to be generated on the basis of spend analysis. Main savings levers: Price competition, Demand management, Total cost of ownership, Contract structuring. Estimation of savings in procurement.

Maturity assessment of procurement business processes. Five groups of processes: Category management, Supplier relationships management, Purchasing, Contracting and Material flow management. Examples of maturity assessment.

Organizational structure benchmarking. Organizational chart analysis. Benchmarking a number of procurement staff. Quantitative metrics for benchmarking. Motivation system.

Procurement data availability check. IT capability mapping. Standard IT functionality utilized in procurement operations. Business requirements for automation in procurement.

Case outline:

You are new Procurement manager of “Green Food”, which runs 3 manufacturing facilities in Switzerland. You had just returned from lunch and checked your voice mail when heard the message from Peter Smith, Vice President of Logistics for “Green Food”, requesting a meeting later that afternoon. He said that he wanted to speak with you about the current performance of the company in managing the procurement process. Although the company’s procurement process had been satisfactory in previous time, you know that Peter was expecting exceptional performance in the future. You need to prepare for a meeting and identify key strengths and future areas for improvements.

Case is tailored for procurement diagnostics exercise and helps to examine new knowledge.

Main references/books/reading:

1. Best practice procurement // London Gower, 2001. – 257 p.
2. David Blanchard. Supply Chain Management. Best practices // John Wiley and Sons, Inc., 2010
3. Jonathan O’Brien. Category management in purchasing: a strategic approach to maximize business profitability // Kogan Page, 2009
4. Muller, N. J. Network planning, procurement, and management // New York McGraw-Hill, 1996. - 480 p.
5. Neef, D. e-Procurement // Prentice Hall, 2001. - 207 p.



6. Ronald H. Ballou. Business Logistics / Supply Chain Management // Pearson Prentice Hall, 2003
7. Stock, J. R. Strategic logistics management. McGraw-Hill/Irwin, 2001. - 872 p.
8. The Purchasing Chessboard™ // AT Kearney, 2008

Theme 4: "Diagnostics in manufacturing"

Theme content (brief):

- Manufacturing key performance indicators
- Product and Process quality diagnostics
- Production performance diagnostics, Rapid plant assessment (RPA)
- Lean & Kaizen typical hypothesis.

Case:

- Reserves for output increase in the production chain of cement producer

Theme outline:

Cost of quality problems. Drivers of the quality problems. Conformance to schedule of production and the drivers for non-conformance. The strategic importance of quality – an organization's competitive environment. The tactical importance of quality – cost of rejects, rework, and scrap and disruptions to operations resulting from quality problems. Product and Process Quality. Quality metrics. Yield loss. Yield loss drivers. A cause and effect analysis of quality problems.

Production performance. Overall equipment efficiency. Downtime analysis. Rated capacity: product of available time, utilization and efficiency. Bottlenecks identification. Input / Output control report. Order Fulfillment Lead Time. Production schedule attainment. MRP Nervousness. Rapid plant assessment (RPA).

7 types of waste in Lean manufacturing. The areas of waste: Excessive Motion, Waiting Time, Over Production, Unnecessary Processing Time, Defects, Excessive Inventory, and Unnecessary Material Movement. Kaizen typical hypothesis: Manufacturing Cycle Time Reduction, Cell layout, Setup/Tool Change Time Reduction, etc.

Case outline:

Supply chain of the Manufacturer of agricultural goods has significant complexity and faces number of issues with late deliveries to the customers due to long gate to gate time, low quantity of appropriate quality infrastructure and the lack of reliable and advanced Logistics providers. Designing a meaningful improvement opportunities is required to enhance customer service, minimize costs and predict future needs in infrastructure change.

Case includes bottlenecks identification at the plant and helps to examine new knowledge in the area of production performance diagnostics.

Main references/books/reading:

1. Darryl V. Landvater. World Class Production and Inventory Management // John Wiley and Sons, Inc., 2 edition, 1997



2. David Blanchard. Supply Chain Management. Best practices // John Wiley and Sons, Inc., 2010
3. F. Robert Jacobs, William Berry, D. Clay Whybark, Thomas Vollmann. Manufacturing Planning and Control for Supply Chain Management // McGraw-Hill Professional; 1 edition (April 19, 2011), 576 p.
4. Hill, T. Manufacturing strategy. New York PALGRAVE, 2000. - 569 p.
5. Markland, R. E. Operations management. Cincinnati South-Western, 1998. - 946 p.
6. Ostwald, P. F. Manufacturing Processes and Systems. John Wiley & Sons, 1997. - 782 p
7. Ronald H. Ballou. Business Logistics / Supply Chain Management // Pearson Prentice Hall, 2003
8. Stock, J. R. Strategic logistics management. McGraw-Hill/Irwin, 2001. - 872 p.
9. Thomas Vollmann. Manufacturing Planning and Control Systems for Supply Chain Management // McGraw-Hill Education, 2005 – 598 p.

Theme 5: “Diagnostics in distribution”

Theme content (brief):

- Key distribution efficiency indicators
- SC network audit: 6-step approach
- Diagnostics for cost savings on transportation
- Warehouse performance assessment
- Distribution business processes maturity assessment: key tips
- Modern IT technologies to support distribution operations

Case:

- FMCG producer: “How good are current 13 DC locations?”

Theme outline:

Distribution. Transportation and Warehousing operations. Transport KPIs: Transportation costs as a % of sales, Logistic service level, Down time (demurrages), Truck utilization. Warehousing KPIs: Economic costs, Useful square utilization, Space utilization, Receiving & Shipping Volumes, Annual Operating Cost. Warehouse Operations Effectiveness. Warehouse Facility Effectiveness.

Distribution network design. Logistic audit of network design. Analyses on product groups, supply chain entities, service levels, product flows, costs and any gaps between the current and desired situation .General Optimal Market Area (GOMA) Model (by D. Erlenkotter).

Distribution business processes maturity assessment. Customer Order Fulfillment. Distribution Operations Quick Analysis. Modern IT technologies to support distribution operations.

Case outline:

A company has 13 distribution centers in its current network configuration. Is it the optimum number? Can you quickly scan it in order to assess, how far it is differed from the optimum number?



Case is tailored to use GOMA model in order to provide a systematic response to a question of a suitability of an existing system, from initial diagnosis to formal results.

Main references/books/reading:

1. David Blanchard. Supply Chain Management. Best practices // John Wiley and Sons, Inc., 2010
2. David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi. Designing and Managing the Supply Chain // McGraw-Hill; 4 edition
3. Donald Erlenkotter. The general optimal market area model // Annals of Operations Research, 1989, Volume 18, Issue 1, pp 43-70
4. Edward Frazelle. World-Class Warehousing and Material Handling // McGraw-Hill, 2013 (4)
5. John J. Coyle, Robert A. Novak, Brian Gibson, Edward J. Bardi. Transportation: A Supply Chain Perspective // Cengage Learning, 7 edition, 2010 (3)
6. Ronald H. Ballou. Business Logistics / Supply Chain Management // Pearson Prentice Hall, 2003.
7. Rushton, A. The handbook of logistics and distribution management. New York Kogan Page, 2001. - 571 p.
8. Stock, J. R. Strategic logistics management. McGraw-Hill/Irwin, 2001. - 872 p.

5. Course assessment

Final grade formula:

$$FG = 0.6 * ((C1+C2+C3+C4+C5)/5) + 0.4 * T, \text{ where}$$

C1, C2, C3, C4, C5 – marks for case work in groups

T – mark for control test

Control test (T) includes closed questions with multiple choice and open ended questions (practical mini-tasks). Open ended questions have higher weight in the test mark.

Evaluation criterion:

From	To	Result
0	3	Fail
4	10	Credit

Summary Table: Correspondence of ten-point to five-point system's marks

Ten-point scale [10]	Five-point scale [5]
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1 – unsatisfactory 2 – very bad 3 – bad	Unsatisfactory – 2
4 – satisfactory 5 – quite satisfactory	Satisfactory – 3
6 – good 7 – very good	Good – 4
8 – nearly excellent 9 – excellent 10 – brilliant	Excellent – 5