Ministry of Education and Science of Ukraine
National Technical University “Dnipro Polytechnik”

Modeling processes in IDEF0 (Integration Definition for Function Modeling)

Lab Manual for the course of
"Modeling and reengineering business processes"
for students specialized in fild of stady 124 – System analisis

Dnipro
2019

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National Technical University “Dnipro Polytechnik”

FACULTY OF INFORMATION TECHNOLOGIES
System Analysis and Control Department

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Затверджено до видання методичною комісією напряму підготовки 124 – Системний аналіз (протокол № 4 від 24.04.2019) за поданням кафедри системного аналізу і управління (протокол № 3 від 20.03.2019).

Методичні рекомендації мають на меті допомогти студентам у самостійному засвоєнні дисципліни «Моделювання та реінжиніринг бізнес-процесів» під час виконання індивідуальних робіт і набуття навичок роботи у середовищі AllFusion Process Modeler. Вони орієнтовані на поглиблення та закріплення теоретичних засад структурного, процесного та об'єктно-орієнтованого підходів до аналізу бізнес-процесів з подальшим їх моделюванням за допомогою CASE-засобів.

Рекомендації орієнтовано на активізацію виконавчого етапу навчальної діяльності студентів спеціальності 124 – Системний аналіз.

The objective of the lab manual is to help students independently master the optional discipline "Modeling and reengineering business processes" while doing the individual task and learning how to deal with AllFusion Process Modeler. The lab manual is aimed at deepening and consolidating the theoretical knowledge on structural, process and object-oriented approaches to the business processes analysis; learning how to apply the methods of analysis for business process modelling; mastering the modelling methods with the help of the CASE-tools.

The manual is aimed at activating the executive stage of students' educational activities fild of stady 124 – System analisis.

Відповідальний за випуск завідувач кафедри системного аналізу і управління, д-р техн. наук, проф. В.В. Слєсарєв.

CONTENTS

INTRODUCTION 5
LIST OF THEORETICAL QUESTIONS 6
PRACTICAL WORK № 1 7
THE BASICS OF OPERATION IN ALLFUSION PROCESS MODELER 7.0 7
THEORETICAL INFORMATION 7
PRACTICAL TASK 8
Creating the A-0 diagram 8
Task 1. Running the program and opening the project. Building a new model 9
Basic AllFusion Process Modeler 7.0 tools 11
Control elements 12
Description 12
Corresponding menu items 12
Task 2. Working with a block 13
Task 3. Creating arrows 15
Task 4. Identifying the control arrow 16
Task 5. Working with a block. 19
Task 6. Adding a squiggle. 20
Task 7. Changing a text color, a block background, an arrow color and style 21
Task 8. Formatting a diagram 24
Task 9. Saving the constructed diagram 25
TEST QUESTIONS 25
PRACTICAL TEST ASSIGNMENT 26
PRACTICAL WORK № 2 28
CONTEXT DIAGRAM DECOMPOSITION 28
THEORETICAL INFORMATION 28
PRACTICAL TASK 28
Task 10. Furniture manufacturing process detailing 28
Task 11. Furniture manufacturing process detailing 30
Task 12. Changing arrow direction 31
Task 13. Constructing arrow branches. 32
Task 14. Creating STAFF and PRODUCTION FACILITIES arrows. 33
Task 15. «Tunneling» arrows. 34
Task 16. Creating a control feedback. 35
Task 17. Saving the diagram 35
TEST QUESTIONS 35

PRACTICAL TEST ASSIGNMENT 35
PRACTICAL WORK № 3 37
FUNCTIONAL MODELING. MODEL DESCRIPTION. 37
THEORETICAL INFORMATION 37
PRACTICAL TASK 39
Task 18. Component manufacturing process detailing 39
Task 19. Quality control process detailing 41
Task 20. Describing model properties 42
Task 21. Preparing a report. 43
PRACTICAL WORK № 4 46
CREATING A NODE TREE DIAGRAM AND A FEO DIAGRAM 46
THEORETICAL INFORMATION 46
PRACTICAL TASK 47
Task 22. Creating a node tree diagram 47
Task 23. Building a FEO diagram 52
Task 24. Saving the diagram 54
TEST QUESTIONS 54
PRACTICAL TEST ASSIGNMENT 54
PRACTICAL WORK № 5 55
CONSTRUCTING A DATA FLOW DIAGRAM 55
THEORETICAL INFORMATION 55
PRACTICAL TASK 58
Task 26. Creating a DFD 58
Task 27. Making external references 59
Task 28. Building data stores 59
Task 29. Making internal references 60
Task 30. Workpiece production process detailing 61
Task 31. Saving the diagram 61
TEST QUESTIONS 61
PRACTICAL TEST ASSIGNMENT 61
LIST OF ABBREVIATIONS 62
LIST OF TERMS 63
RECOMMENDED SOURCES FOR SELF-STUDY 65

INTRODUCTION

Production technologies, sales markets and customer needs are continuously changing. It directly affects the activity of business entities and its result. Nowadays, an active development of the modern change management concepts is taking place. One of the most effective tools for managing change is the process approach to management. This approach is based on the enterprise business process description and control. But it is necessary to use modern information technologies to develop efficient managerial decisions and to ensure the completeness and timeliness of business processes information representation, the possibility of their modeling, analyzing and forecasting.

Business process modelling is an effective tool for the optimization of the company's activities. It is used to forecast and minimize the risks arising at various stages of enterprise reorganization.

Several types of methodologies are used to describe, model and analyze business processes. The most common types include IDEF0, IDEF3, DFD, BPMN.

The course "Modeling, analysis and reengineering of business processes" consists of the theoretical and practical parts.

The laboratory works are aimed at deepening and consolidating the theoretical knowledge on structural, process and object-oriented approaches to the business processes analysis; learning how to apply the analysis methods for the modelling of business processes; mastering the modelling methods with the help of the CASE-tools.

The purpose of this manual is to provide students with the theoretical information and practical recommendations for the efficient individual work on the lab tasks and modular control preparation.

This publication includes the necessary theoretical material, a description of the methodology used to do these laboratory works. It provides the task examples for each lab, control questions, and the content of the report. Each laboratory work contains individual tasks.

AllFusion Process Modeler 7.0 CASE Tool (BPwin) is recommended for Business Process Modelling. This tool supports the IDEF0, IDEF3 and DFD methodologies, and allows the users to analyze, document, and plan changes of complex business processes by collecting all the necessary business information and its graphic representation as a coherent and consistent model.

The laboratory work assessment criteria take into account the level of mastering the theoretical and practical material, the correctness of the task performance, the autonomy and timeliness of its implementation and the completing of the report on time.

List of Theoretical Questions

1. What are the reasons of the process approach development?
2. List the features of the process approaches.
3. What are the advantages and disadvantages of the process approaches?
4. What is a business process?
5. What types of business processes do you know?
6. What features does a main business process have?
7. What is a supporting process?
8. What is a providing business process?
9. What features does the process of development have?
10. What is the business process of management?
11. What is the process input?
12. What is the process output?
13. What does the process mechanism include?
14. What is the process control?
15. What is a model?
16. What types of models do you know?
17. What are the differences between cognitive and pragmatic models?
18. What are the main directions of modeling?
19. What are the properties of a model?
20. What are the requirements for process modeling?
21. List the stages of the business processes description and modeling.
22. What stages of the enterprise business area description do you know?
23. What does the description of activities (functions, business processes) include?
24. What does the description of the organizational structure include?
25. What ways of business processes description and modeling do you know?
26. What does the description of enterprise business areas include?
27. How is the description of the responsibility distribution done?
28. What are the rules of building an activity tree?
29. What are the conditions for completing the decomposition of business processes?
30. How deep and long is the business process decomposition?
31. What is the organizational structure of an enterprise?
32. How is the description of the organizational structure done?
33. What is the purpose of the context diagram creation?
34. List the steps of the contextual diagram decomposition.
35. How many functions can be placed in one diagram?
36. How are the functions named?
37. How many inputs (outputs) can each block have?
38. What types of feedback do you know?
39. How is the information feedback displayed in a diagram?
40. How is the control feedback displayed in a diagram?

PRACTICAL WORK № 1

THE BASICS OF OPERATION IN ALLFUSION PROCESS MODELER 7.0

With the help of this laboratory work you will be able:

- to learn the basic components of the AllFusion Process Modeler 7.0 operation interface;
- to get into the technology of a new model creation;
- to edit a constructed diagram.

THEORETICAL INFORMATION

To simplify the modeling of business processes in IDEF0, it is possible to use the AllFusion Process Modeler 7.0 CASE environment which is able to present a functional decomposition of the system clearly.

AllFusion Process Modeler 7.0 is a tool that entirely supports standard IDEF0, which was based on SADT and adopted in the USA in the early 90s.

The basic idea of the SADT methodology is building a *tree-like functional* model of an enterprise.

First, the enterprise functionality is described in general, without details. Such description is called a context diagram (fig. 1.1).

Interaction with the environment is described in the terms of an *input*, an *output*, a *control* and *mechanisms*.

Input is data or objects consumed or modified by a function;

Output is the main result of the function operation, the end product or service;

C**ontrol** means strategies and procedures that control the function;

Mechanisms are necessary resources (staff or production facilities).

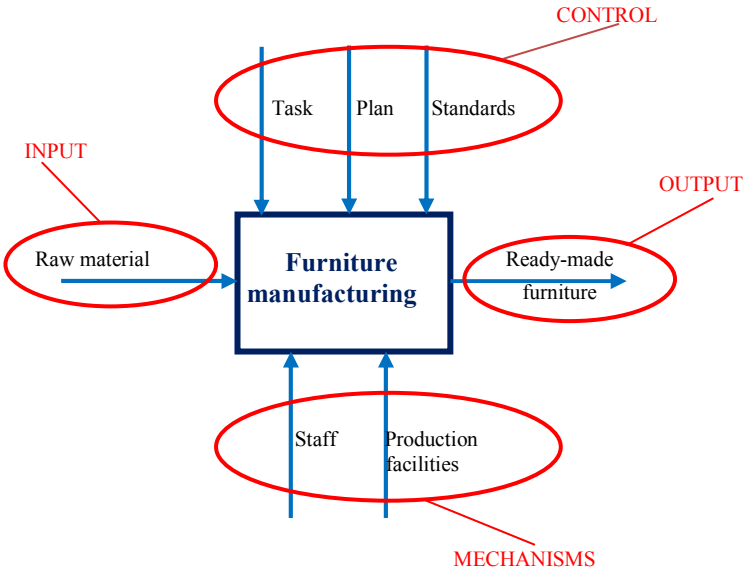


Fig. 1.1. An IDEF0 diagram example

Moreover, when building a context diagram, *its purpose, scope* (a description of what will be considered as a system component and as an external exposure) and *viewpoint* (a starting point for model creation) should be identified. As a rule, the viewpoint of the person or object responsible for the system operation is chosen.

The general function is divided into large subfunctions. This process is called a *functional decomposition*.

Then each subfunction is broken into smaller-sized functions until you get the necessary detailing of the description. In such a manner, an IDEF0 diagram is built.

Stages of building a model

1. Identify the main business process.
2. Construct a context diagram.
3. Build a high-level process diagram.
4. Make a functional decomposition of each process with the help of detail diagrams.

PRACTICAL TASK

Creating an A-0 diagram

We will consider building the model of a business process using the example of a furniture factory. During the enterprise study, its target functions, each unit functional activities and functional interactions, information flows inside the units and between them, external objects and external information influence, regulatory documentation, enterprise data on tools and automation systems were revealed.

Target functions of a furniture factory:

- raw material processing;
- component fabrication;
- assembling;
- quality control.

Furniture factory regulatory documentation:

- drawings (a detail drawing, an assembly drawing);
- raw material processing standards;
- quality standards;
- manufacturing instructions;
- safety instructions.

Enterprise units:

- a raw material and spoiled (rejected) product processing shop;
- a manufacturing shop;
- an assembling shop;
- a quality control department.

The main raw material for furniture manufacturing is *wood*, but rejected (or spoiled) products can also be recycled and used for manufacturing.

Target functions can help identify the main business process. As the main objective of the furniture factory is to manufacture furniture, then the main business process is *Furniture Manufacturing*.

After that a context diagram should be built. In this case, it represents the most general description of the system. There can be only one context diagram in a model.

To construct a context diagram, we should specify *the input information* (data or material resources) which is transformed during the process in order to achieve the result; *the output information* which is the final result; *the control* which influences the process, but it is not transformed by the process; and *the mechanisms* which execute the process.

First, the necessary information for the context process of *Furniture Manufacturing* should be defined:

- INPUT - raw materials;
- CONTROL – drawings, manufacturing instructions, safety instructions (regulatory documentation);
- MECHANISMS – staff, production facilities;
- OUTPUT – manufactured (ready-made) furniture.

Task 1. Running the program and opening the project. Building a new model.

1. Start **AllFusion Process Modeler 7.0**.
2. Choose the operating mode: **Create model**.
3. Enter the name of the model in the field *Name*: **Furniture Manufacturing**.
4. In the **Type** group, choose the diagram type: **Business Process** (**IDEF0**) (fig. 1.2).

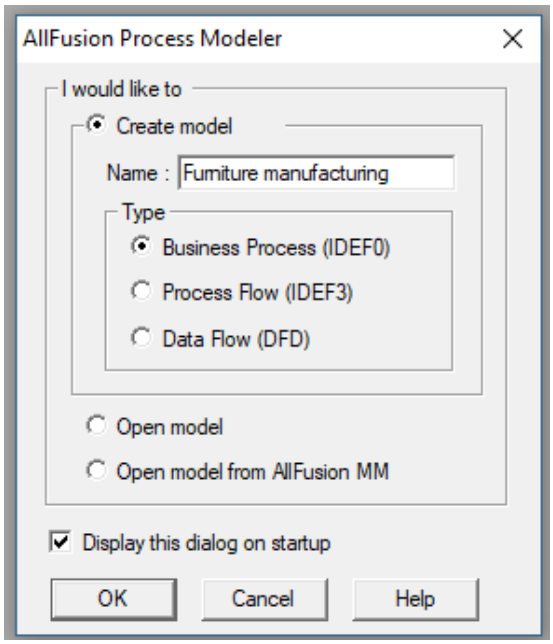


Fig. 1.2. The model construction dialog box

5. Click OK.

When you click OK, the **Properties for New Models** dialog box opens (fig. 1.3).

6. Enter your surname and initials.

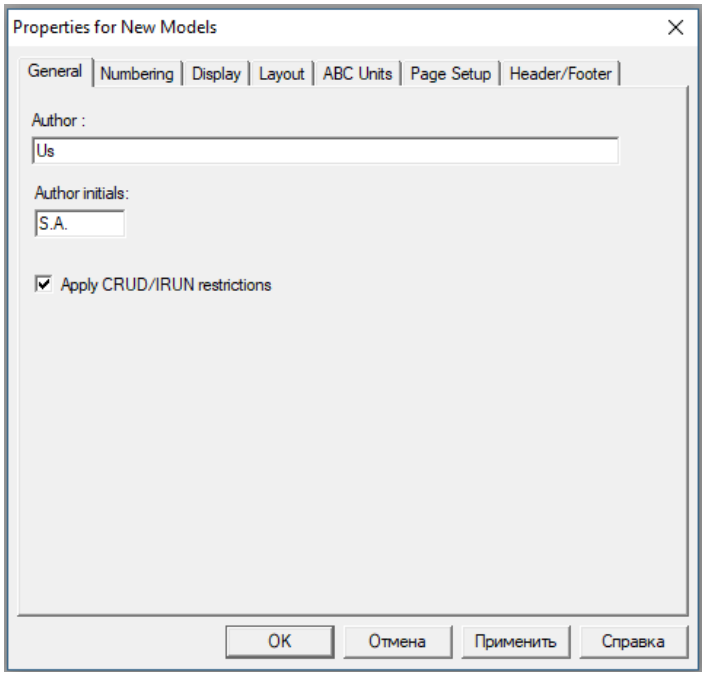


*Fig. 1.3. The **Properties for New Models** dialog box*

Then a standard AllFusion Process Modeler 7.0 dialog box appears (fig. 1.4):

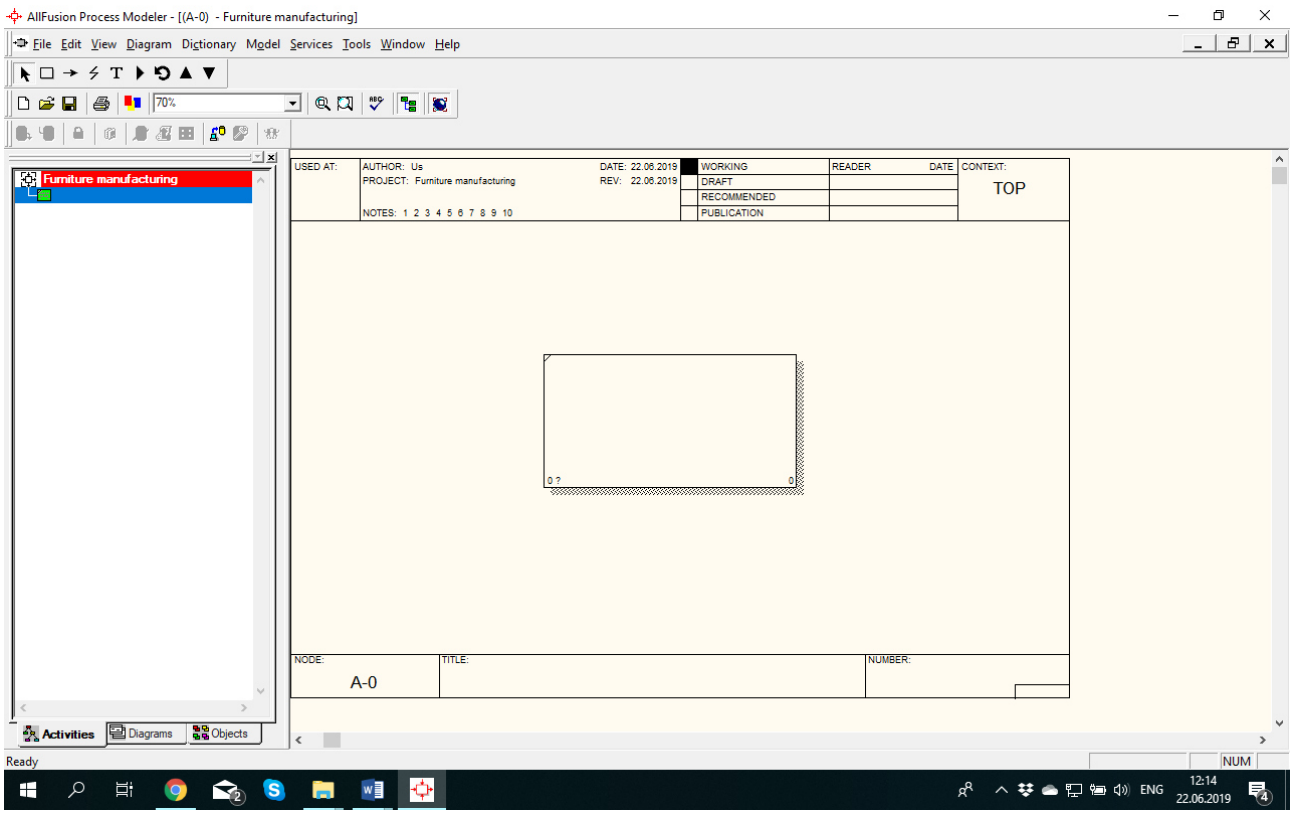


Fig. 1.4. The AllFusion Process Modeler 7.0 standard dialog box

Basic AllFusion Process Modeler 7.0 tools

All basic operations with diagrams, such as creating, editing, etc. can be executed with the help of the main or context menu (a menu which opens when clicking the right mouse button). The menu operation rules are standard for the Windows environment: first, the object is activated, and then the necessary operations are performed.

The control elements are located on the main toolbar (fig. 1.5):

Fig. 1.5. The control elements of AllFusion Process Modeler 7.0

Toolbar functionality is accessible from the AllFusion Process Modeler 7.0 main menu (tab. 1).

Table 1.1

The main toolbar control elements of AllFusion Process Modeler 7.0

Control elements	Description	Corresponding menu item
	Create a new model	File/New
	Open a model	File/Open
	Save a model	File/Save
	Print a model	File/Print
	Call the report generator **Report Builder**	Tools/Report Builder
	Scale selection	View/Zoom
	Scaling	View/Zoom
	Spell checker	Tools/Spelling
	Turning on and off the **Model Explorer** navigator	View/Model Explorer
	Enabling and disabling the additional toolbar for working with **ModelMart**	ModelMart

The tools of the AllFusion Process Modeler 7.0 editor for IDEF0 diagrams are located on the main toolbar (or in any desired place of the screen) (fig. 1.6).

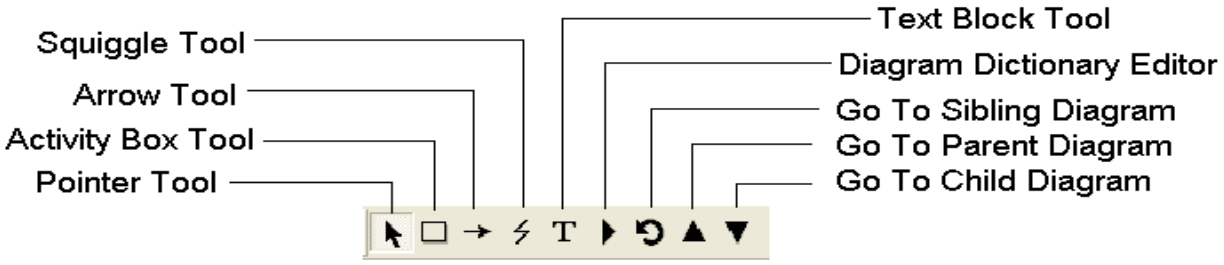


Fig. 1.6. The toolbar of the AllFusion Process Modeler 7.0 editor

Table 1.2

The tools of the AllFusion Process Modeler 7.0 editor

Edit item	Description	Item Name
	Select and determine the position of the objects added to the chart.	Pointer Tool
	Insert blocks into a diagram	Activity Box Tool
	Add the arrow to a diagram	Arrow Tool
	Create a squiggle that connects the arrow with its name	Squiggle Tool
	Create Text Block	Text Block Tool
	Open the **Diagram Dictionary Editor** dialog box where you can move to any diagram or create a new one	Diagram Dictionary Editor
	Display the next diagram of the same level	Go to Sibling Diagram
	Go to the parent diagram.	Go to Parent Diagram
	Display a child diagram or decompose the selected block into a child diagram	Go to Child Diagram

Task 2. Working with a block

Building a context diagram of *the **Furniture Manufacturing process***

To enter the name of the block:

1. Click the right mouse button on the block.
2. Choose **Name**.
3. Enter **Furniture Manufacturing** into the dialog box (fig.1.7).

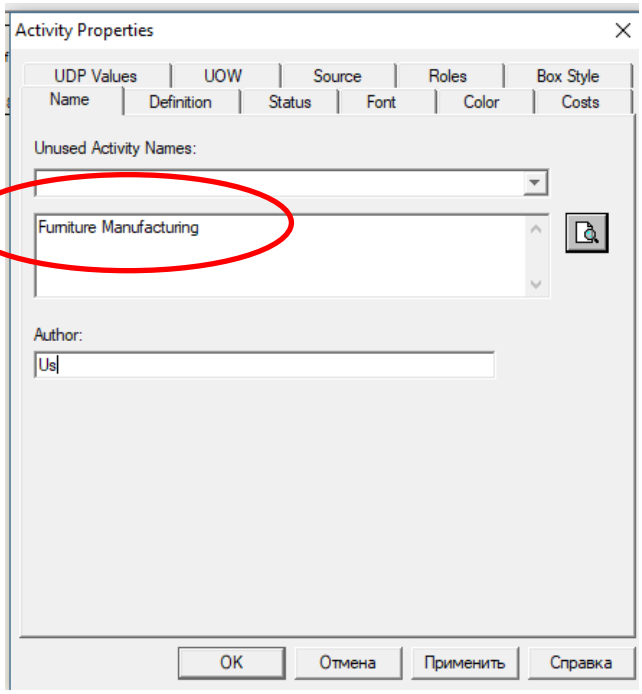


Fig. 1.7. The AllFusion Process Modeler 7.0 dialog box

4. Choose **Font** in the context menu to make the text clear (fig. 1.7)
5. In the **Activity Properties** dialog box that appears**,** select *check-boxes* in **Apply setting to** to change the font for all operations in the current diagram.
6. Select **Arial Unicode MS** font, regular type, 16 pt. (fig. 1.8).

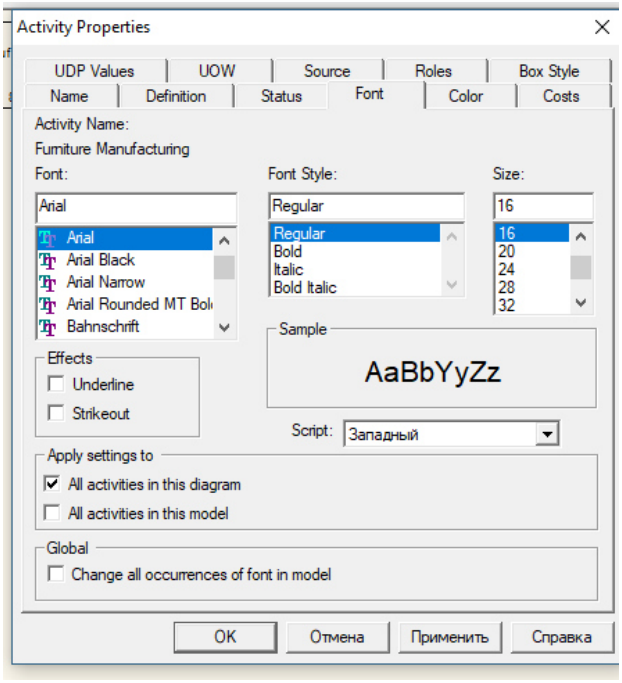


*Fig. 1.8. The **Font** tab of the **Activity Properties** dialog box*

When this operation is completed, demonstrate the result to the teacher (fig. 1.9).

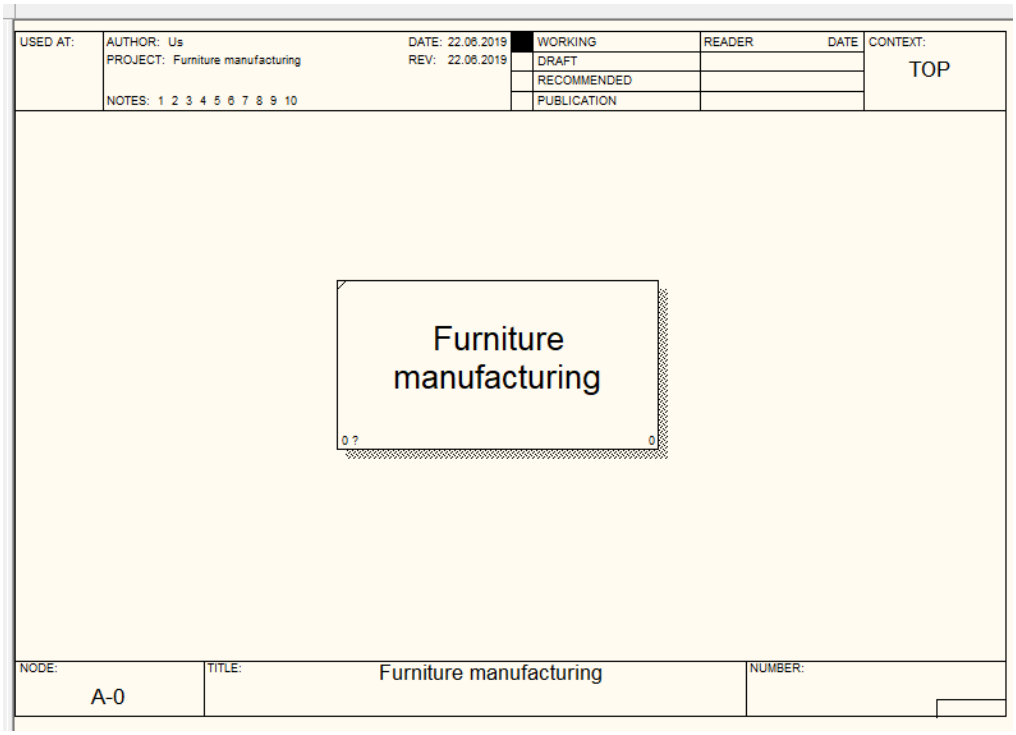


Fig. 1.9. Task 2 result

Task 3. Creating arrows

In order to construct a **control** arrow:

1. Select → button on the toolbar.
2. Point a cursor to the top edge of the diagram construction dialog box until a black stripe appears, and then left-click on this stripe (fig. 1.10).

Fig. 1.10. The first step in the arrow construction

3. Point a cursor of the mouse to the top side of the block until a dark triangle appears, and then click the left mouse button (fig. 1.11).

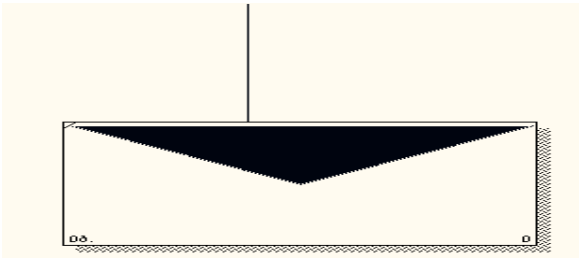


Fig. 1.11. Construction of the control arrow

The **input** arrow and the arrow of **mechanisms** are constructed in the same way.

4. Construct the **input** arrow and the arrow of **mechanisms**.

The same operations, but taken in the reverse order, are used for construction of the **output** arrows: from the right side of the block to the right side of the diagram construction dialog box.

5. Construct the **output** arrow.

Task 4. Identifying the control arrow

1. Choose button on the edit panel.
2. Click the right mouse button on the arrow.
3. Choose **Name** (fig. 1.12).

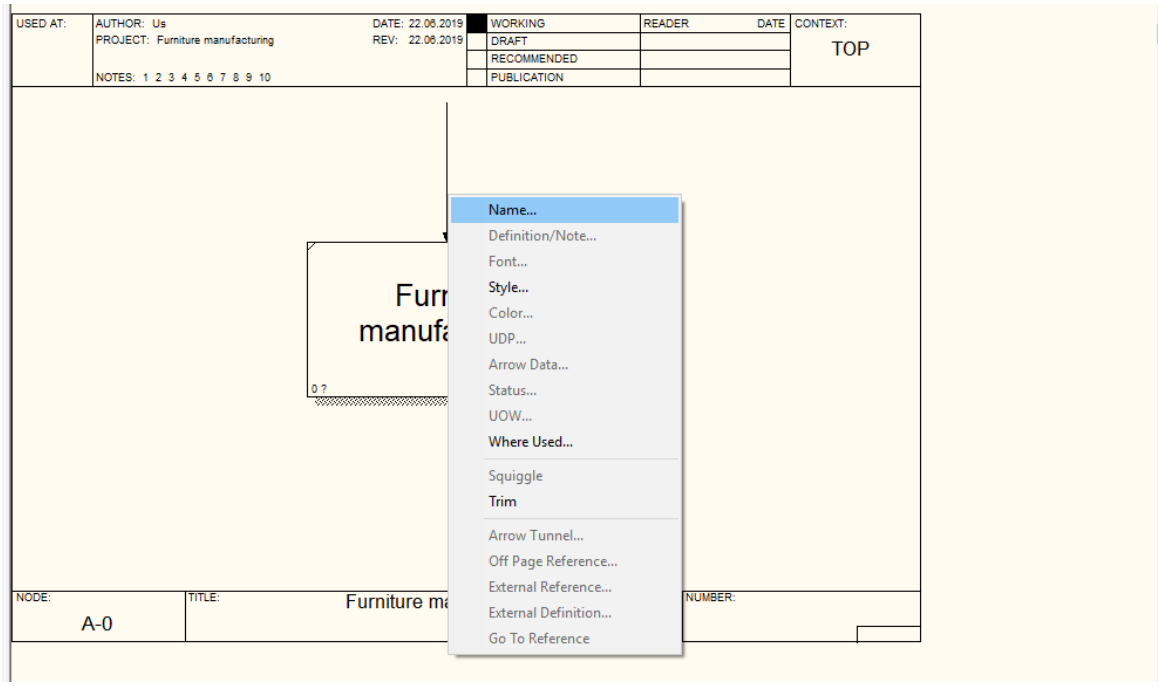


Fig. 1.12. The context menu

4. Enter the arrow title **Regulatory documentation** in the dialog box (fig. 1.13).

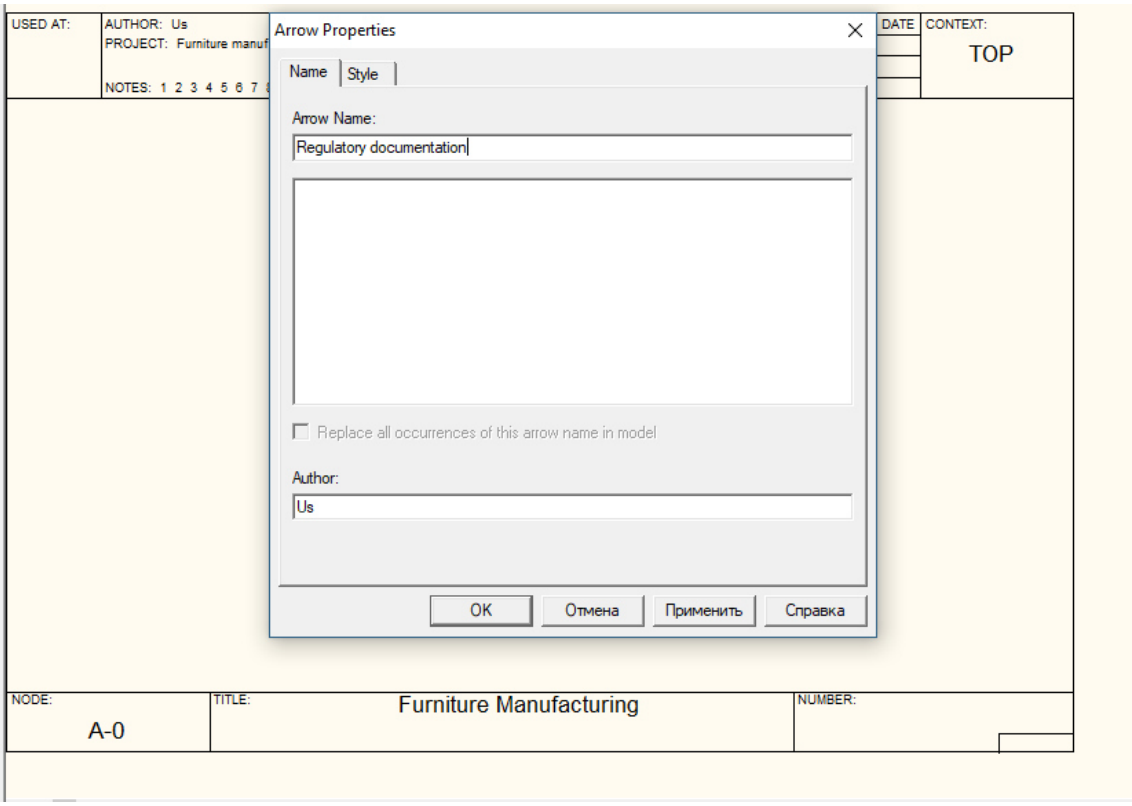


*Fig. 1.13. The **Arrow Properties** dialog box*

5. Choose **Model - Default Fonts** menu to make the text of the arrow clear (fig 1.14).

AllFusion Process Modeler 7.0 allows setting a font by default for the objects of a particular type (for example, arrows) in diagrams and reports. After choosing the **Model - Default Fonts** menu, a dropdown menu appears where each item serves for setting the fonts for a particular object type (fig. 1.14):

1. **Context Activity** – an operation in a context diagram;
2. **Context Arrow** – arrows in a context diagram;
3. **Decomposition Activity** – an operation in a diagram of decomposition;
4. **Decomposition Arrow** – arrows in a diagram of decomposition;
5. **Node Tree Text** – a text in a node tree diagram;
6. **Frame User Text** – a text added by a user to a diagram frame;
7. **Frame System Text** – a system text in a framework of diagrams;
8. **Text Blocks** – text boxes;
9. **Parent Diagram Text** – a text of a parent diagram;
10. **Parent Diagram Title Text** – a text of the title of a parent diagram;
11. **Report Text** – a text of the report.

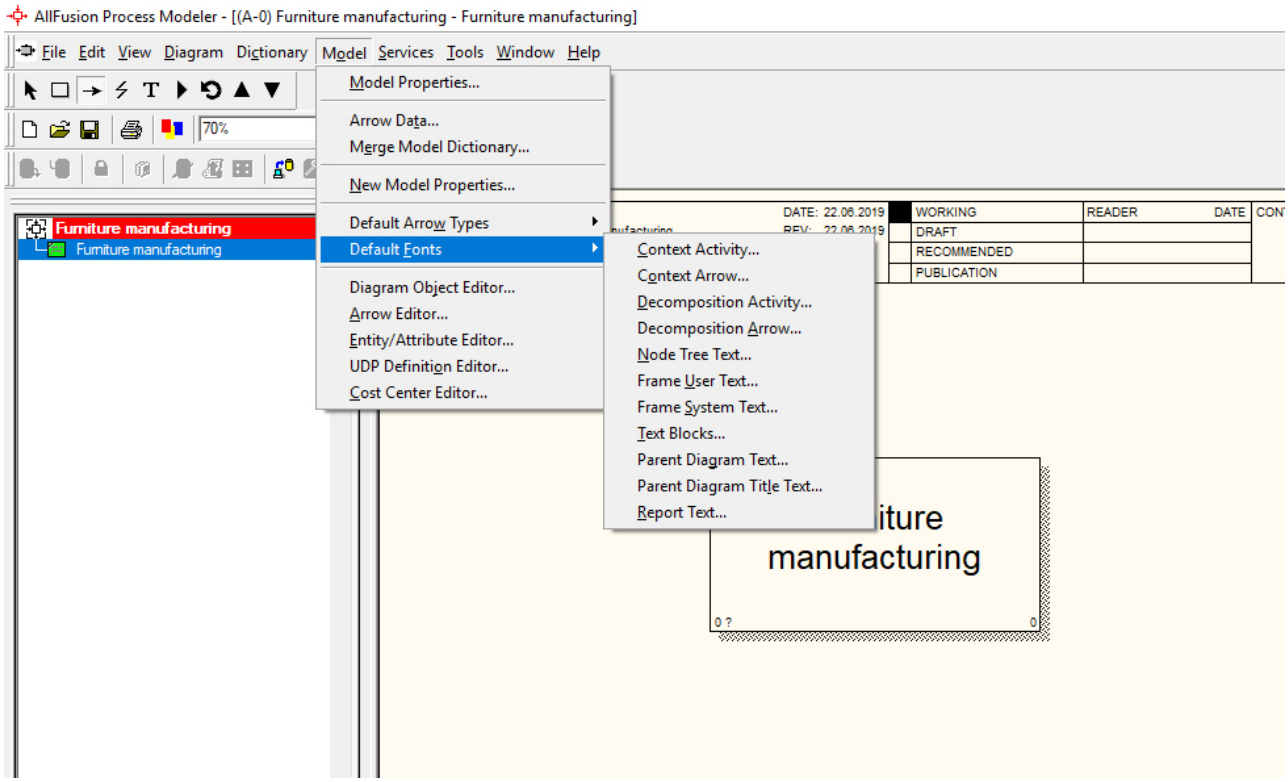


*Fig. 1.14. The **Model - Default Fonts** dialog box*

6. Select a check-box in the **Change all occurrences** option in the bottom part of the **Default Context Arrow Name Text Font** dialog box to change the title font of all arrows in the current diagram.

7. Select **Arial Unicode MS** font, italic type, 14 pt (fig. 1.15).

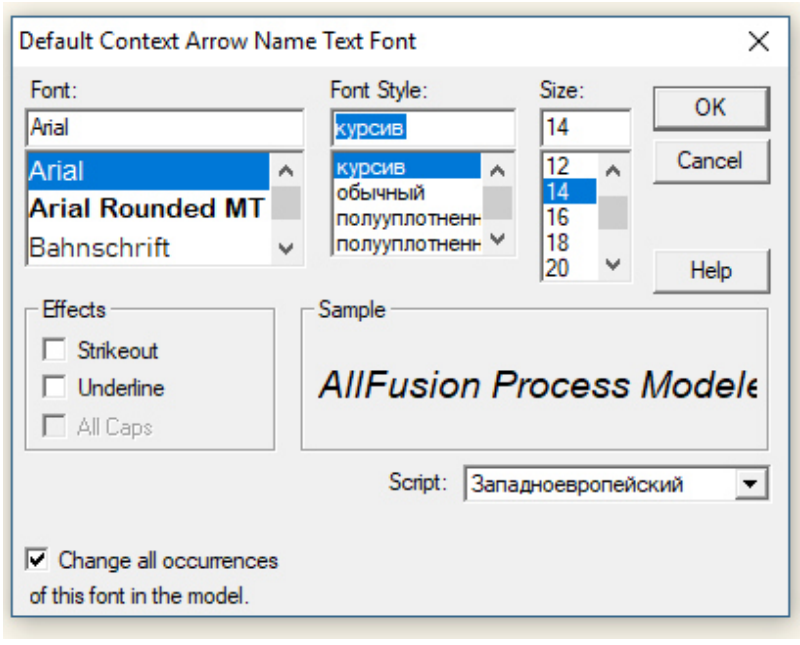


*Fig. 1.15. The **Default Context Arrow Name Text Font** dialog box*

Here is a fragment you should obtain (fig. 1.16).

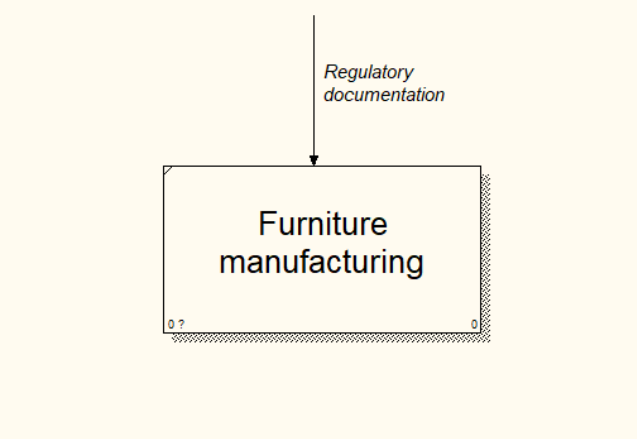


Fig. 1.16. The diagram fragment

Task 5. Working with a block.

Construct the arrows independently:

INPUT: «Raw materials»;

MECHANISM: «Staff», «Production facilities»;

OUTPUT: «Ready-made furniture».

When this work is done, demonstrate your result to the teacher.

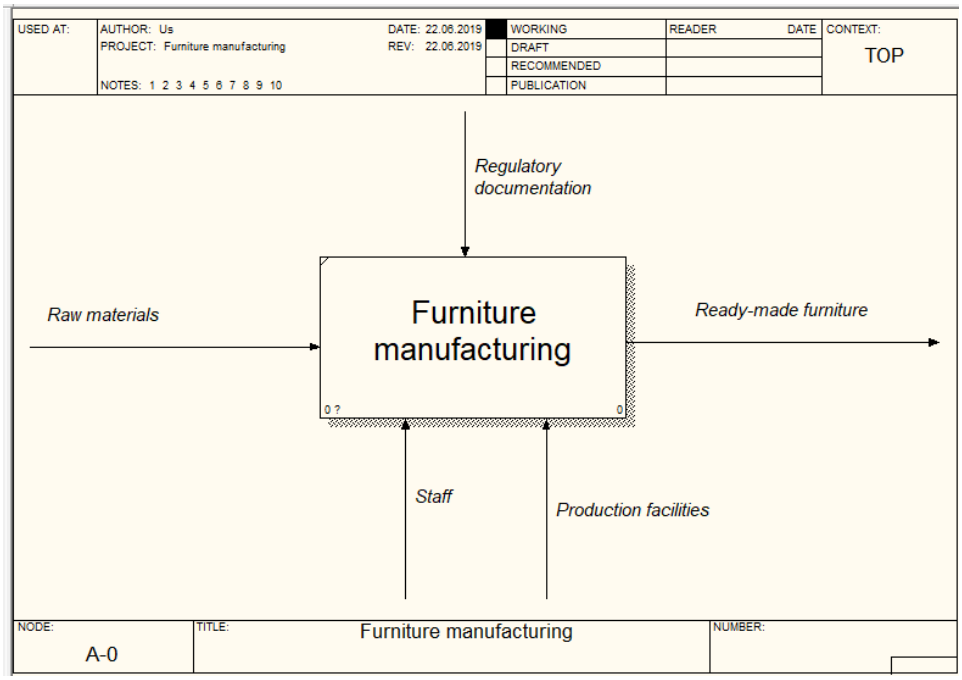


Fig. 1.17. The result diagram for Task 5

Task 6. Adding a squiggle

The arrow title is an independent object which can be moved separately. A text can be placed in a free form relatively to the arrow or connected with the arrow by a squiggle (tilde) symbol.

In order to set a tilde it is necessary to:

1. Click ⚡ button on the toolbar;
2. Click the left mouse button on text and then on the arrow (fig. 1.18);

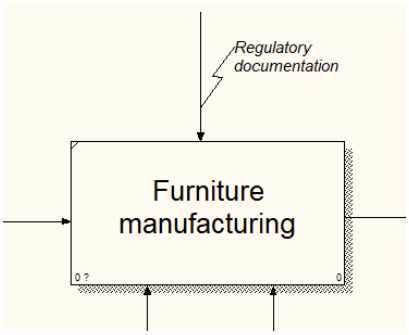


Fig. 1.18. Adding a squiggle

3. It is also possible to use a **Squiggle** command of the context menu (fig. 1.19).

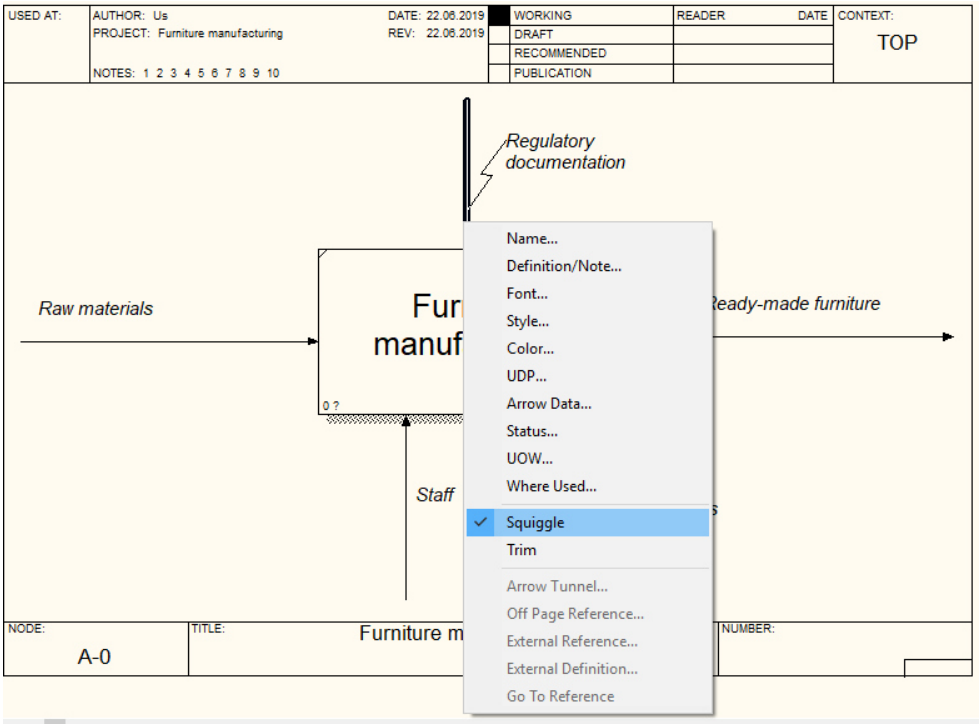


Fig. 1.19. The context menu

An arrow consists of separate graphic objects: straight-line sections, curved sections, and an arrow pointer. Separate elements can be moved independently changing the arrow shape. Also, the arrow can be moved as one indivisible element.

4. Add a tilde to other arrows and their titles.

Task 7. Changing a text color, a block background, an arrow color and style.

1. You can change the color of the text using the context menu command **Color** (fig. 1.20):

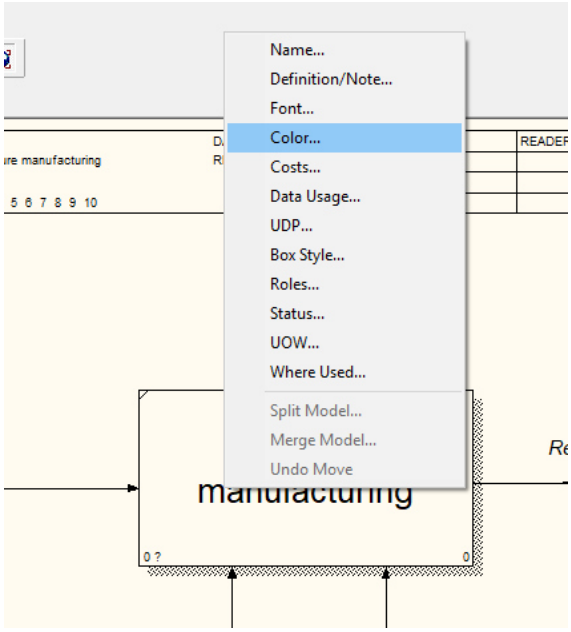


Fig. 1.20. The context menu

2. Choose the color and click the button OK (fig. 1.21).

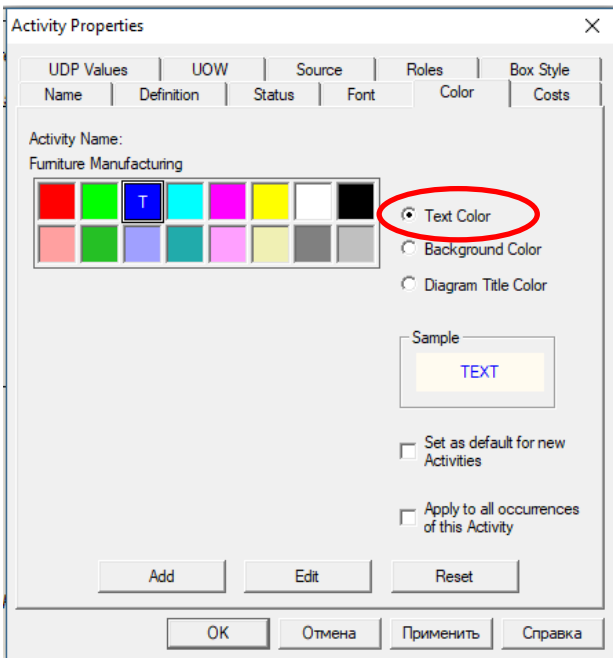


Fig. 1.21. Choosing a text and arrow color

3. Select the necessary color in the **Background Color** option to change the block background (fig. 1.22):

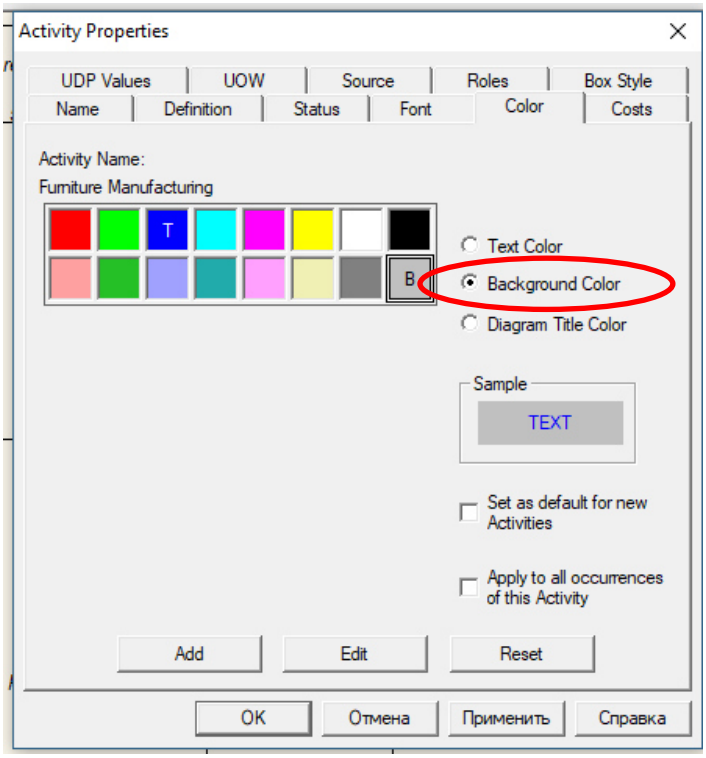


*Fig. 1.22. The **Color** Tab of the **Activity Properties** dialog box*

4. Select **Style** in the shortcut menu in order to change the style of the arrow (fig. 1.23):

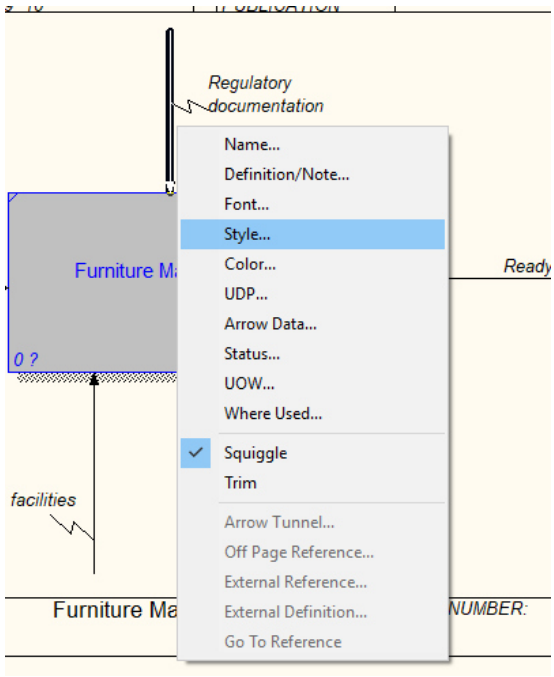


Fig. 1.23. A shortcut menu

5. Specify the arrow type and style in the dialog box and click **OK** (fig.1.24).

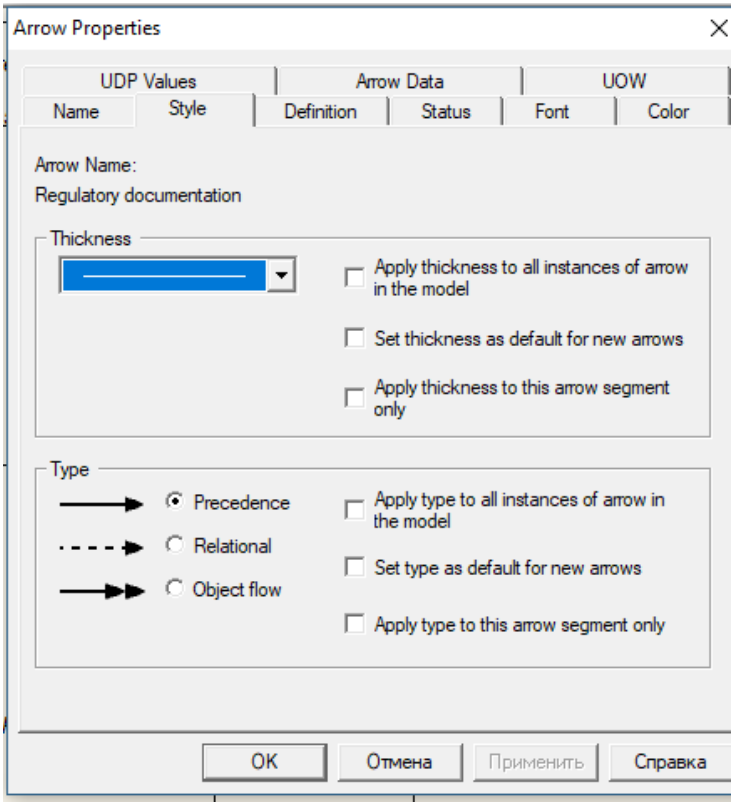


*Fig. 1.24. The **Arrow Properties** dialog box*

You should obtain the following fragment (fig. 1.25).

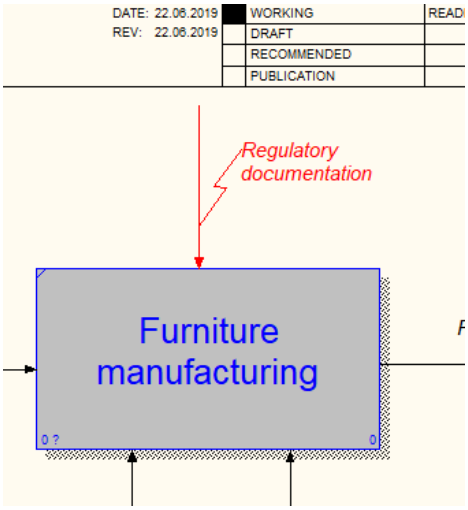


Fig. 1.25. Formatting of the diagram elements

Deleting blocks, arrows and a text.

In order to delete a block, an arrow or a text, it is necessary to activate them by left clicking and then click **Delete** and confirm your operation.

Task 8. Formatting a diagram

1. Format all the elements of the diagram by using the information given in the table 1.3.

Table 1.3

Table of editing

Object	Operation	Performance procedure
Block	Re-sizing	Drag-and-drop the top or bottom block boundary with the mouse in order to change the height; the horizontal size can be changed similarly.
Text	Standard formatting	Click the right mouse button on the text, select **Font Editor** in the shortcut menu.
Arrow	Changing of style, color or size	Right-click on the arrow and select an appropriate option: **Style Editor, Color Editor** or **Trim**
Deleting blocks, arrows or a text: activate the required object by clicking the left mouse button and then click **Delete** and confirm the operation.		

When you complete the task, you will get the following context diagram (fig. 1.26):

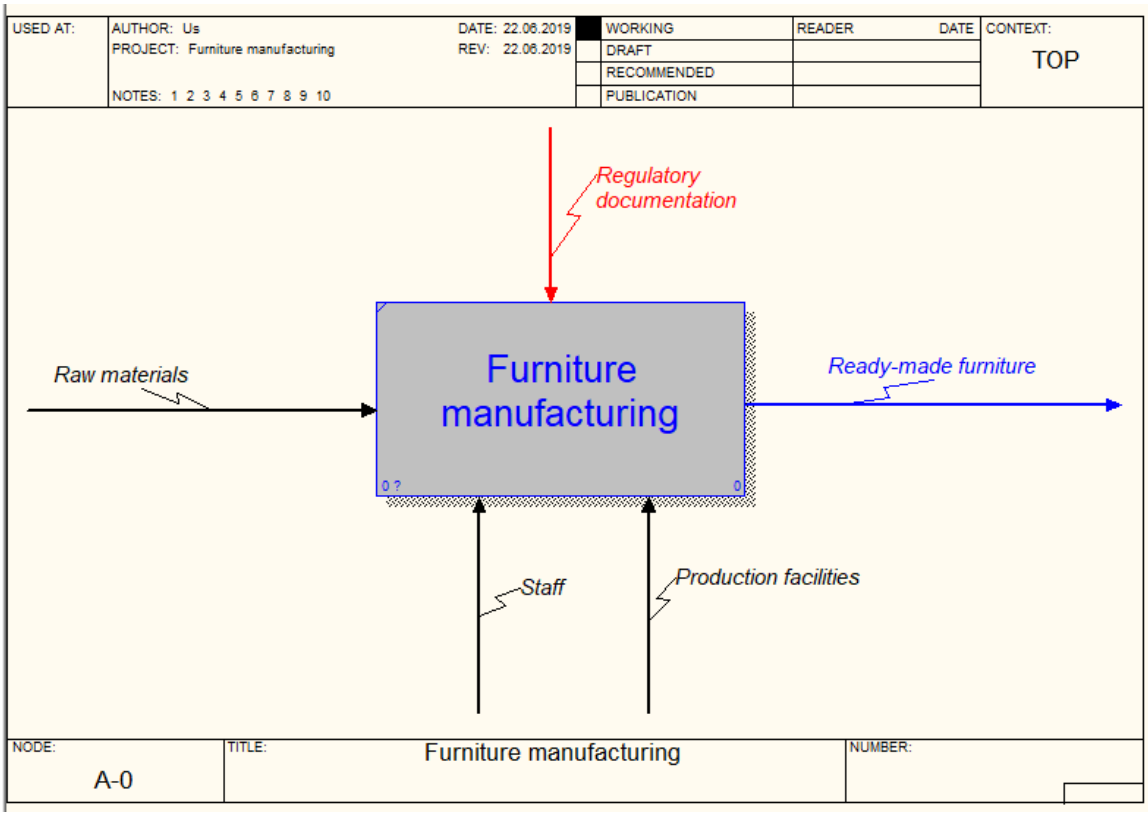


*Fig. 1.26. The **Furniture Manufacturing** context diagram*

When this work is done, demonstrate your result to the teacher.

Task 9. Saving the constructed diagram.

Save the constructed diagram.

1. Create a folder, label it with your surname and save your work in it.
2. In the **File** menu choose **Save as.**
3. Specify the way to your folder and enter the name of the file **Lab1.bp1** (fig. 1.27).

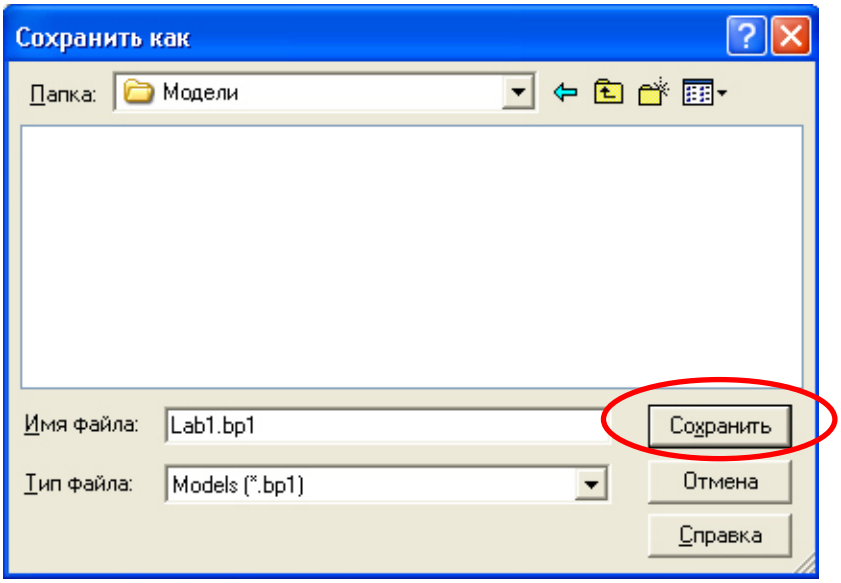


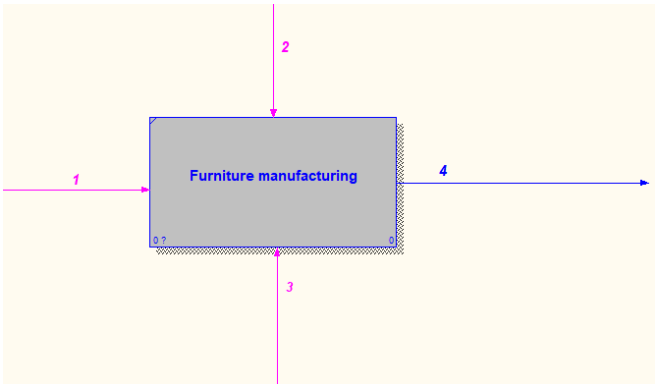
Fig. 1.27. The Dialog box of document saving

4. Click **SAVE**.

TEST QUESTIONS

Answer the following questions:

1. List the basic functions of AllFusion Process Modeler 7.0.
2. Describe the basic elements of the AllFusion Process Modeler 7.0 operation interface.
3. What methodology does AllFusion Process Modeler 7.0 support?
4. Specify the purpose of each arrow shown in the picture below.



5. Name the main stages of building a model.
6. What process can be called a functional decomposition?
7. List the elements of a context diagram.
8. What tool is used for arrow construction in a diagram?

TEST TASKS

The following tasks are developed for independent construction of the business process model. To complete the task it is necessary to:

1. describe the main purpose and its function;
2. identify the main business process;
3. construct a context diagram;
4. construct a higher-lever diagram;
5. make a functional decomposition of each process with the help of detail diagrams;
6. prepare a report;
7. construct a DFD diagram;

You have to select a task from the Table 1.4 according to your option. You will be carrying out this task during all laboratory works (№№ 1 – 4) while gradually studying and practicing to work in AllFusion Process Modeler 7.0.

Before starting a test task of the laboratory work №1, you have to:

1. Identify the target functions of the enterprise.
2. Specify the enterprise units and regulatory documentation.
3. Define input information (data or material resources).
4. Define output information which is a final result.
5. Specify the process executing mechanisms.
6. Create a new file in the AllFusion Process Modeler 7.0 program.
7. Construct and format a context diagram.
8. Save a new file in your folder with the name Kr1.bp1.

The report should contain all the paragraphs (1 – 6).

Table 1.4

List of the tasks

Variant number	Subject area
1	Product sale.
2	Service sale.
3	Procurement.
4	Marker research.
5	Product manufacturing.
6	Marketing impact.
7	External incoming document processing.
8	Decision making management.
9	Holding a meeting.
10	SWOT- analysis.
11	Arranging negotiations.
12	Competitor price research.
13	Making an agreement.
14	Customer satisfaction survey.
15	Material preparation for a company website.
16	Creating a unique selling point.
17	Conferencing.
18	Preparation for participation in the exhibition.
19	Benchmarking.
20	Preparation of the product presentation.
21	Questionnaire survey.
22	Incident management.
23	Delegating authority.
24	Procurement of a logistic company.
25	Product or service improvement.

PRACTICAL WORK № 2

A CONTEXT DIAGRAM DECOMPOSITION

With the help of this laboratory work you will be able:

- to make a context diagram decomposition;
- to create and tunnel arrows.

THEORETICAL INFORMATION

Decomposition

When the context diagram describing the modelling system context is created, functional decomposition is made: the system is broken into subsystems and each subsystem is described with the same syntax as the whole system. Then each subsystem is divided into smaller sub-parts each of which can be broken down further until a sufficient level of detail is achieved. In result, each fragment of the system is presented as a separate *decomposition diagram which describes the operation detail.*

In the process of decomposition all the arrows (data-flows) into and out of the diagram should be transferred to a lower level diagram and used for its construction. Therefore, there **cannot be any new input and output arrows** (data-flows) except so called "tunneling" arrows.

Creation of a A0 diagram

The high level diagram is created by decomposing the main function of the context diagram. The functions in the decomposition diagram are numbered automatically from left to right. The function number is marked in the right bottom corner. At the same time, a small diagonal line disappears in the left top corner showing that the given function has been decomposed.

PRACTICAL TASK

Task 10. FURNITURE MANUFACTURING process detailing

Open the file **Lab1.bp1** saved at the previous lesson.

The next step is to detail the context process with the help of the high level diagram. This diagram comprises four processes:

1. Process 1.1 – RAW MATERIAL PROCESSING
2. Process 1.2 – MANUFACTURING OF THE COMPONENTS
3. Process 1.3 – ASSEMBLING
4. Process 1.4 – QUALITY CONTROL

Detail the **Furniture manufacturing** process by creating the required number of new blocks (boxes). To do this:

1. Click on the **Furniture Manufacturing** box and select ▼ tool.
2. Select 4 in the number of activities in the decomposition in the **Activity Box Count** Dialog as **Furniture Manufacturing** consists of four processes.
3. Indicate the type of the diagram IDEF0 (fig. 2.1) and click OK.

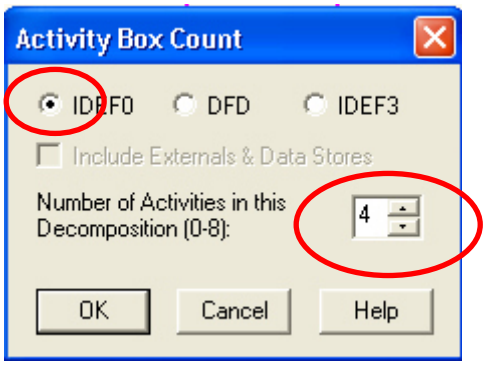


Fig. 2.1. A block decomposition dialogue box

4. Name the new blocks: "***Raw material processing", "Component manufacturing", "Assembling", "Quality control".***

In the process of functional decomposition input and output arrows automatically appear in the decomposition diagram (migration of arrows) but they do not contact the boxes. Such arrows are called untied and perceived in AllFusion Process Modeler 7.0 as a syntax error (fig. 2.2).

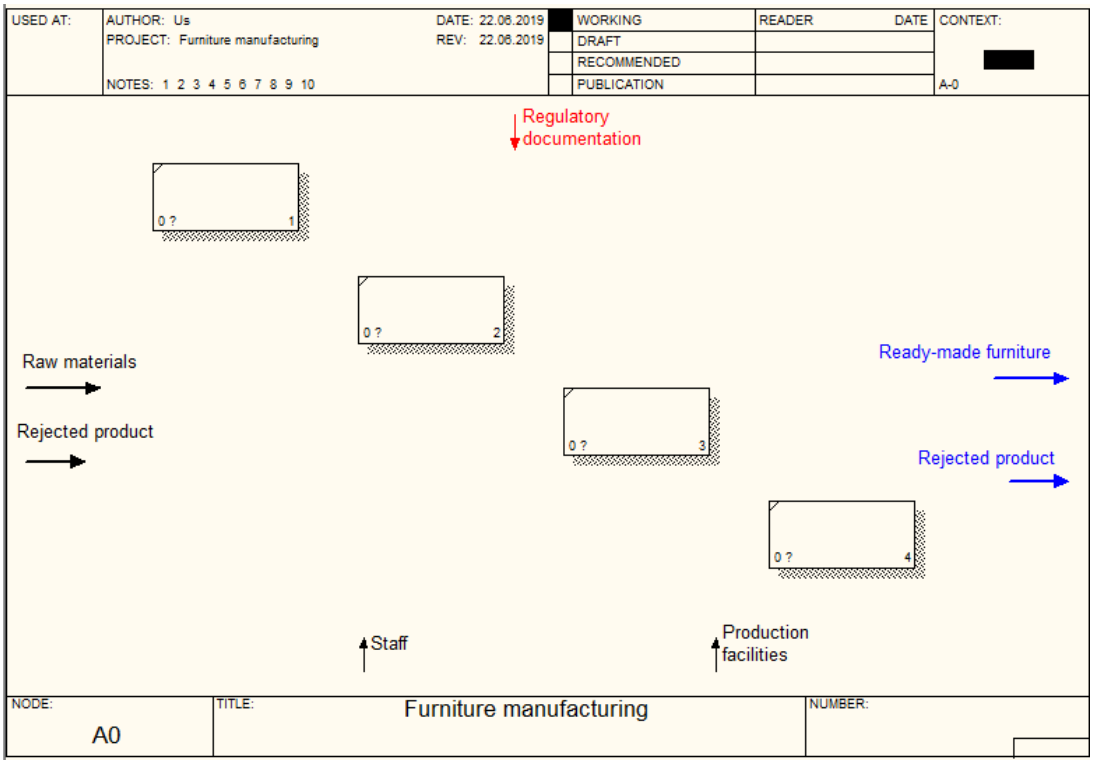


Fig. 2.2. High level decomposition

We should identify the input and output data-flows of the new processes.

Process 1.1. – RAW MATERIAL PROCESSING:

1. Input – RAW MATERIALS.
2. Input – REJECTED PRODUCT.
3. Output – SEMI-COMPONENTS.

To connect the migrating arrows:

5. Select the arrow tool →.
6. Click the mouse on the pointer of the input flow RAW MATERIALS.
7. Click on the input side of the RAW MATERIAL PROCESSING box.

The REJECTED PRODUCT input flow will be created later.

To construct the SEMI-COMPONENTS output flow, you should:

8. Select the arrow tool →.
9. Click the left mouse button on the output side of the RAW MATERIAL PROCESSING box.
10. Click on the input side of the MANUFACTURING OF THE COMPONENTS box.
11. Select the text tool **T**, find **Name** in the context menu, and label (name) the semi-component arrow.
12. Check your work (fig. 2.3).

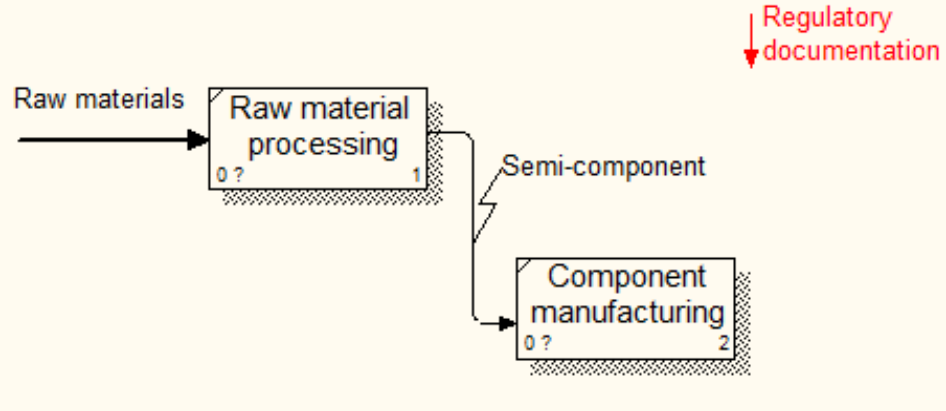


Fig. 2.3. The diagram fragment

Task 11. FURNITURE MANUFACTURING process detailing.

Detail the following processes independently:

Process 1.2. MANUFACTURING OF THE COMPONENTS:

1. Input – SEMI-COMPONENTS.
2. Output – COMPLETED COMPONENTS.

Process 1.3. ASSEMBLING:

1. Input – COMPLETED COMPONENTS.
2. Output – ASSEMBLED PRODUCT.

Process 1.4. QUALITY CONTROL:

1. Input – ASSEMBLED PRODUCT.
2. Output – READY-MADE FURNITURE.
3. Output – REJECTED PRODUCT.
4. Output – INDUSTRIAL WASTE

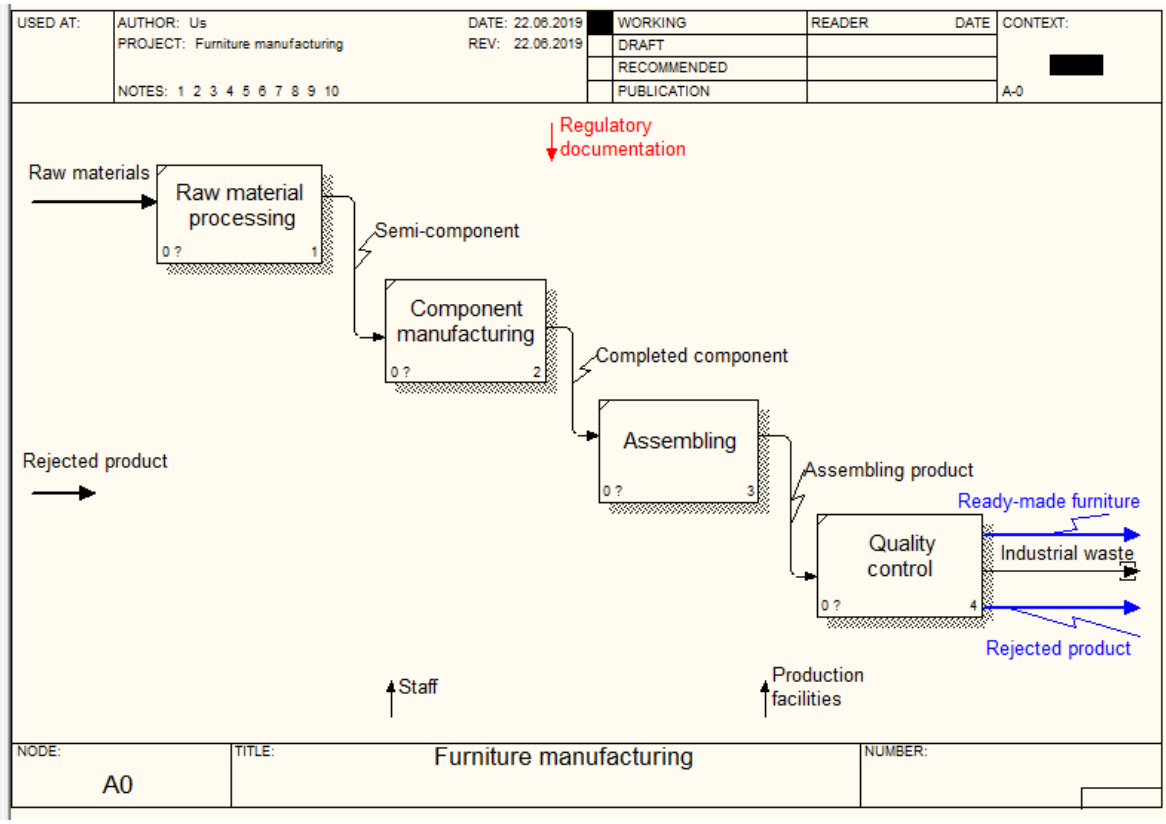


Fig. 2.4. The process of decomposition

When this task is completed, demonstrate the result to the teacher.

Task 12. Changing arrow direction

The REJECTED PRODUCT output flow does not get out of the model boundary but returns to the RAW MATERIAL PROCESSING box:

1. Remove the REJECTED PRODUCT (input) and REJECTED PRODUCT (output) arrows.
2. Select the arrow tool .
3. Click a left mouse button on the output of the CONTROL box.
4. Click a left mouse button on the input of the RAW MATERIAL PROCESSING box.

5. Name a new arrow REJECTED PRODUCT (fig. 2.5)

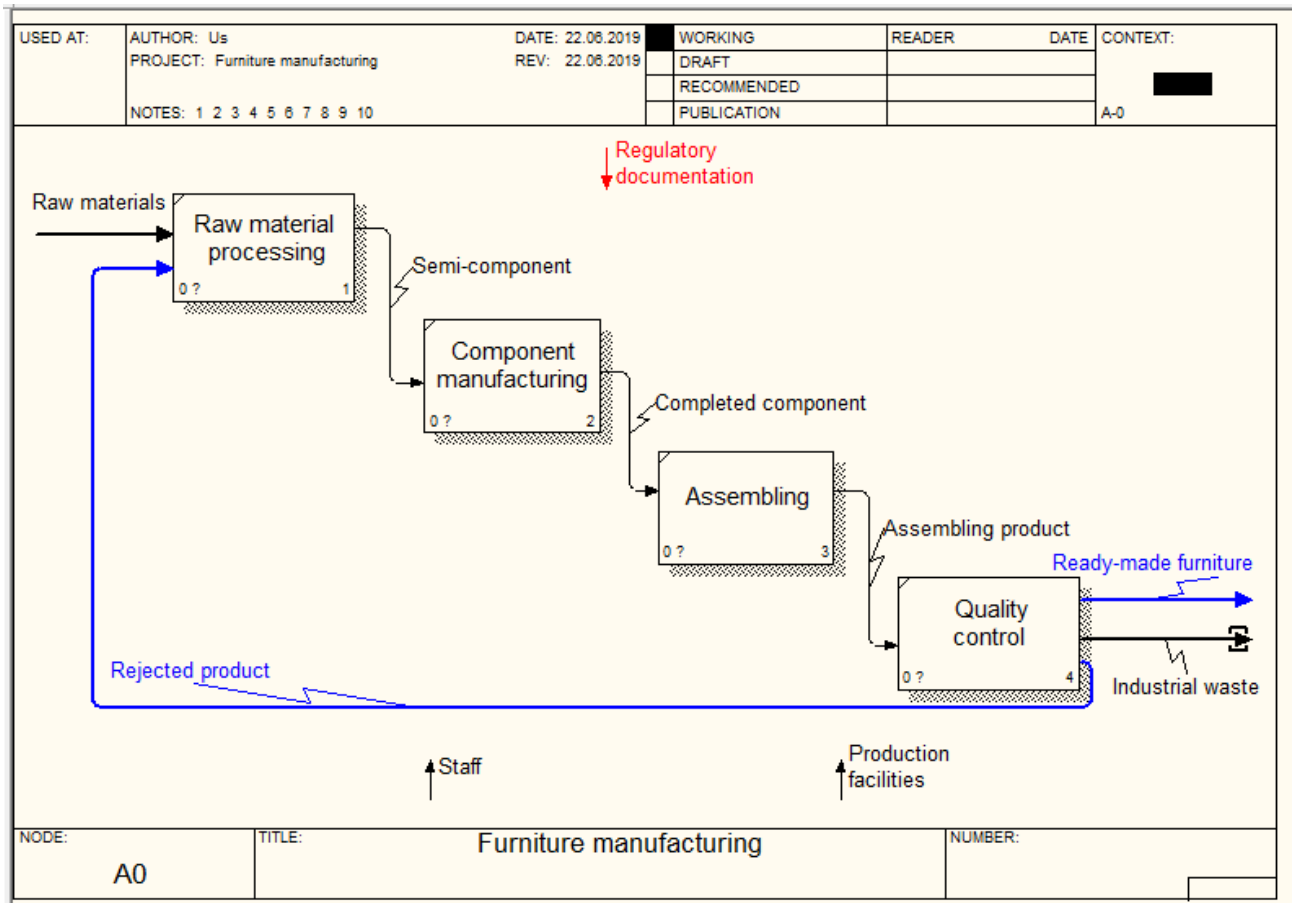


Fig. 2.5. The changing arrow direction

Task 13. Constructing arrow branches.

Processing of raw materials, manufacturing of the components, assembling of the items, and quality control are carried out according to the regulatory documents. Therefore, the REGULATORY DOCUMENTATION control arrow will have some branches: RAW MATERIAL PROCESSING STANDARDS, COMPONENT DRAWINGS, ASSEMBLY DRAWINGS, and QUALITY STANDARDS.

1. Select the arrow tool →
2. Click on the pointer of the input flow REGULATORY DOCUMENTATION.
3. Click on the input side of the RAW MATERIAL PROCESSING box.
4. Independently create the branches of the REGULATORY DOCUMENTATION arrow for the COMPONENT MANUFACTURING, ASSEMBLING and QUALITY CONTROL boxes.
5. Check your work (fig. 2.6).

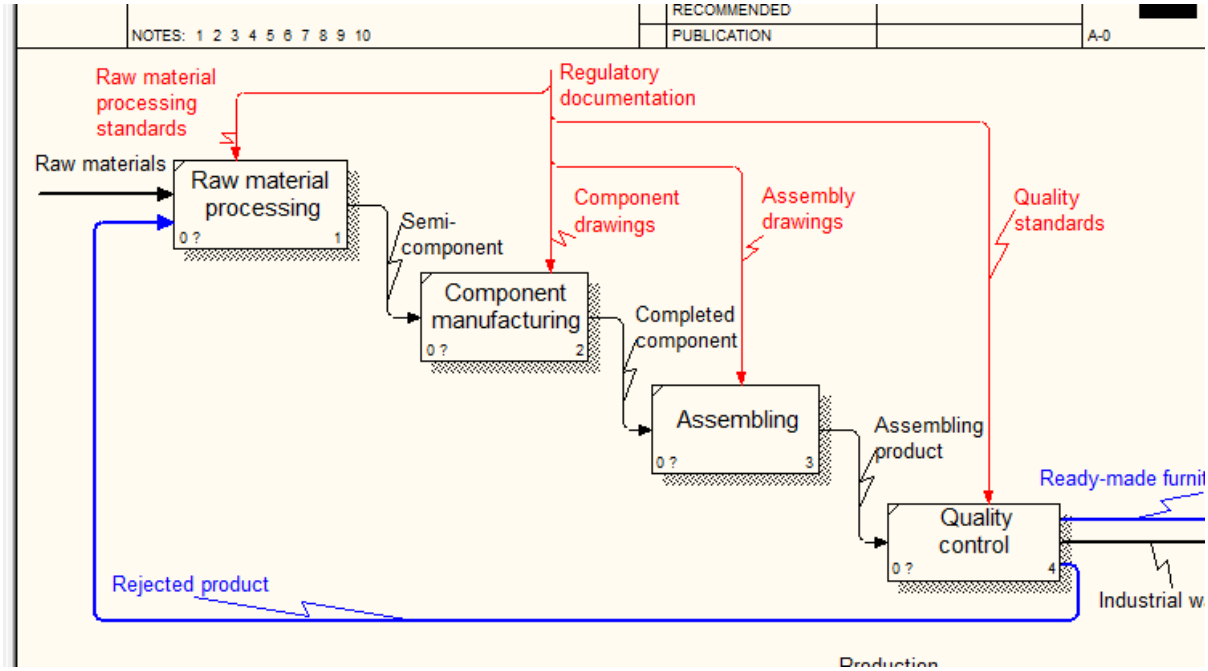


Fig. 2.6. ***Regulatory documentation*** *arrow branches*

Task 14. Constructing the STAFF and PRODUCTION FACILITIES arrows.

The STAFF and EQUIPMENT arrows will be identical for all the processes.

1. Independently connect each arrow with every block and label its name.
2. Check your work (fig. 2.7).

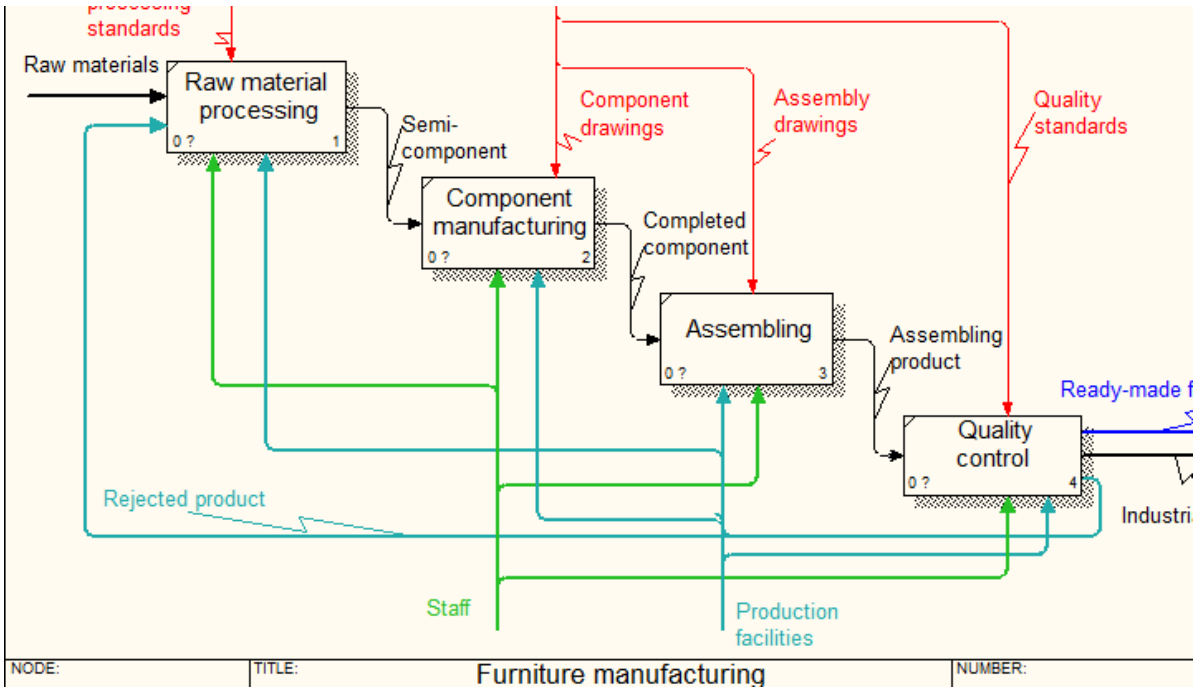


Fig. 2.7. Construction of the ***Staff*** *and* ***Production Facilities*** *arrows*

When this task is completed, demonstrate the result to the teacher.

Task 15. «Tunneling» the arrows.

1. Create a new border arrow for 1.2. COMPONENT MANUFACTURING box and label this output flow as INDUSTRIAL WASTE.

New border arrows created in the lower level decomposition diagram are marked in square brackets and do not emerge automatically in the high level diagram.

For their "dragging" upward it is necessary to:

2. Select editing tool.
3. Click the right mouse button on the square brackets.
4. Select **Arrow Tunnel** in the context menu.
5. Click **Resolve it to border arrow** (fig. 2.8) button in the **Border Arrow Editor** dialog box to migrate the arrow to the high level diagram or click **Change it to resolved rounded tunnel** button to tunnel the arrow.

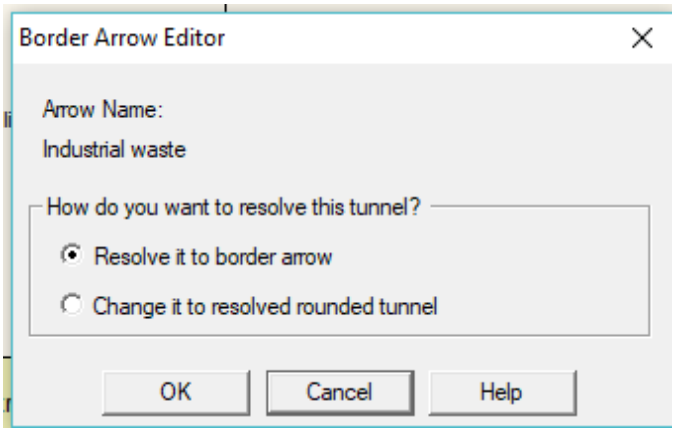


Fig. 2.8. Border Arrow Editor dialog box

The tunneled arrow is marked with parentheses (round brackets) on the end and does not appear in another diagram (fig. 2.9). Tunneling can be used for minor (not significant) arrows.

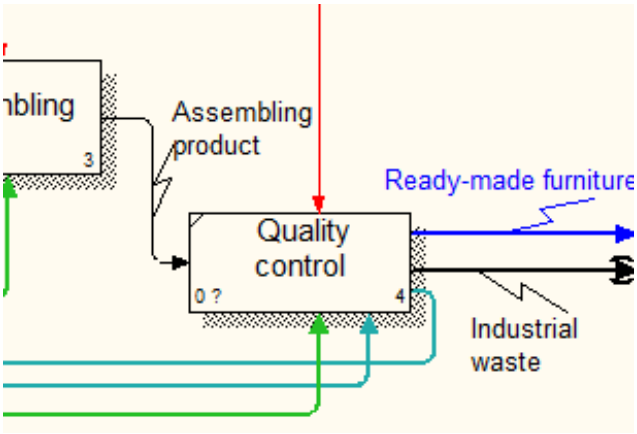


Fig. 2.9. A border arrow

6. Tunnel the newly created INDUSTRIAL WASTE arrow.

Task 16. Creating a control feedback.

The product quality can be increased by the direct regulation and control of the component manufacturing and furniture assembling processes according to the results (output) of the QUALITY CONTROL.

The control feedback indicates the business-process efficiency. To create it, you should:

1. Select the arrow tool →
2. Click the mouse on the QUALITY CONTROL output flow.
3. Click on the COMPONENT MANUFACTURING and ASSEMBLING boxes.
4. Select the text tool T
5. Name the feedback RECOMMENDATIONS.

When your operation is completed, you will get the following diagram (see fig. 2.10).

Task 17. Saving the diagram

1. In the **File** menu select **Save as.**
2. Indicate the route to your folder and name the file **Lab2.bp1**.
3. Click OK.

When this task is completed, demonstrate the result to the teacher.

TEST QUESTIONS

1. How is a high level diagram created?
2. How is decomposition displayed in a diagram?
3. What tool is used to specify the amount of activities in decomposition?
4. What arrows are identified as syntax errors by AllFusion Process Modeler 7.0?
5. What is the purpose of the control feedback?
6. What is the arrow “tunneling” used for?

TEST TASK

Continue the completion of the test task.

1. Open file **Kr1.bp1.**
2. Detail the business process.

Name the file **Kr2.bp1** and save it in your folder.

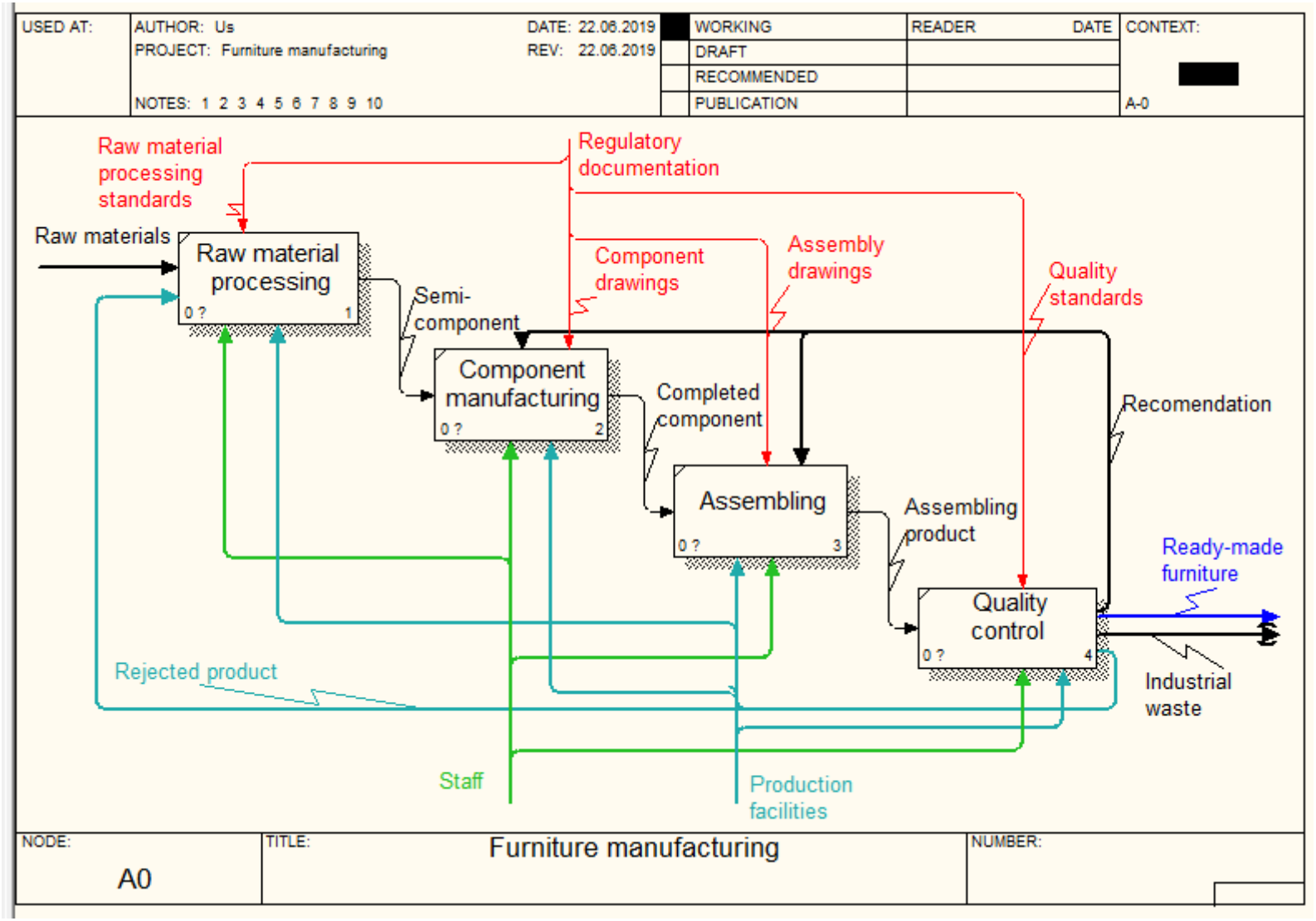


*Fig. 2.10. The **Furniture manufacturing** decomposition diagram*

3. PRACTICAL WORK № 3

FUNCTIONAL MODELING. MODEL DESCRIPTION.

With the help of this laboratory work, you will be able to:

- learn how to detail processes;
- describe model properties;
- learn how to make a report on the model properties;
- construct a node tree diagram;
- set a node tree diagram style and properties;
- build a FEO diagram.

THEORETICAL INFORMATION

The final step in building a model is **functional decomposition**. The constructed high level diagram also has many processes which can be detailed in the lower level diagrams. This is how the IDEF0 hierarchy is built with the context diagram at the top of it.

The process of decomposition continues until the desired level of detail is achieved. When building the IDEF0 hierarchy, each lower level process needs to be correlated with the high level process. Usually, for this purpose all the models are numbered. A number consists of a prefix and a No. A prefix of any length can be used, but usually A is used as a prefix.

The context tree has a number A0. The diagrams of the A0 decomposition have the numbers A1, A2, … AZ, etc. Decompositions of the lower level have the number of the parent diagram and the next serial number. For example, A3 decomposition will have the numbers A31, A32, A33, A34, etc.

The diagrams make a tree-like hierarchy where each diagram can have one parent and several child diagrams. Such a tree is called a node tree, and the numbering is called a node numbering.

There are some formats of numbering which can be set in the **Numbering** tab (fig. 3.1) of the dialog **Model Properties** (menu **Model – Model Properties**).

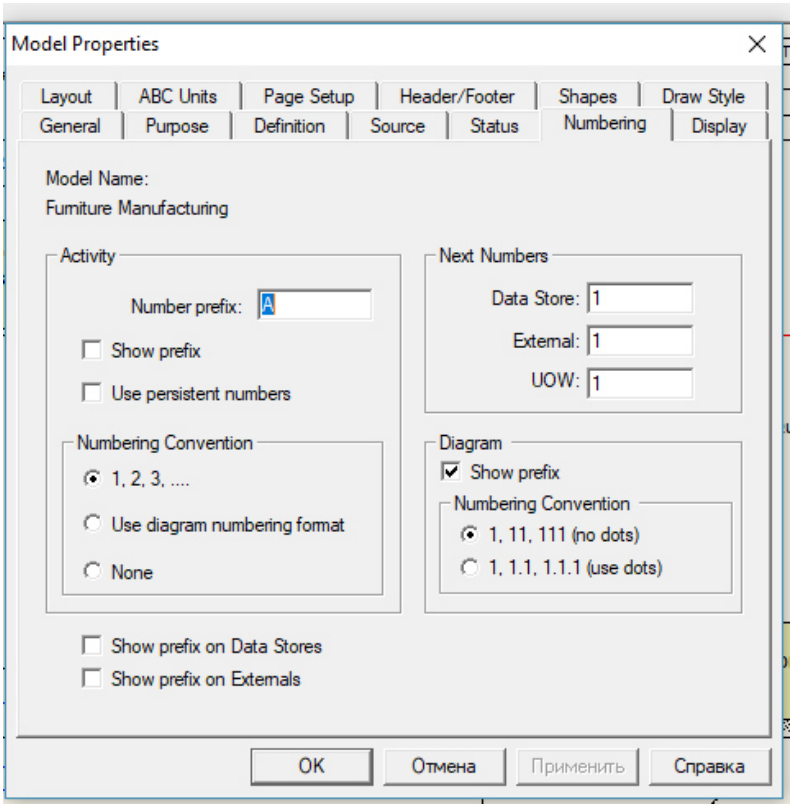


*Fig. 3.1. The **Numbering format setting** dialog box*

The **IDEF0** *diagrams are double numbered.* First, the diagrams have node numbers. The context diagram is always numbered A-0, the decomposition of the context diagram is A0, and the remaining decomposition diagrams are numbered according to the corresponding node (for example, A1, A2, A21, A213, etc.).

AllFusion Process Modeler 7.0 *automatically supports node numbering*, i.e. during decomposition, a new diagram is created and the corresponding number automatically appears. The diagrams can be refined and changed after examination, therefore, different versions of the same (from the point of view of its location in the node tree) decomposition diagrams can be created. AllFusion Process Modeler 7.0 allows having only one decomposition diagram in the given node. The previous versions of the diagram can be stored as a paper copy or as a FEO diagram. (Unfortunately, when creating FEO-diagrams, there is no possibility of rollback, i.e. it can be obtained from the FEO decomposition diagram but not vice versa.)

In any case, different versions of the same diagram should be distinguished with the help of a special number – C-number, which must be assigned by the author of the model manually. C-number is an arbitrary string, but it is recommended to follow the standard with an alphabetic prefix and a serial number, where the initials of the author are used as a prefix, and the serial number is added manually by the user, for example **SRO00021** (fig. 3.2).

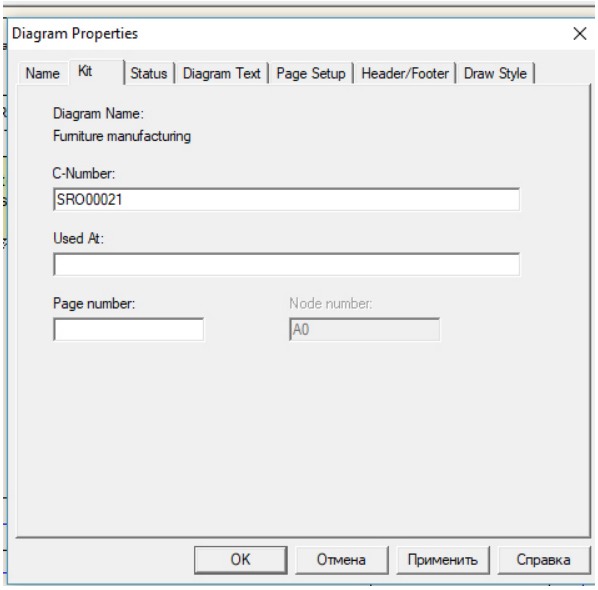


Fig. 3.2. The diagram number assignment dialog box

PRACTICAL TASK

In the previous laboratory work you created the context diagram of the "FURNITURE MANUFACTURING" process and detailed it with the help of the high level diagram. The last step of the model construction is functional decomposition, which means splitting complex processes into more simple ones. This decomposition process continues until the required detail level is achieved.

Task 18. COMPONENT MANUFACTURING process detailing

1. Open file **Lab2.bp1**, which was saved at the previous lesson.
2. Detail the process **1.2. MANUFACTURING OF THE COMPONENTS** with the low level diagram. The necessary data is given in the Table 3.1:
3. Select the tool ▼ and click on the block MANUFACTURING OF THE COMPONENTS;
4. In the Dialog window type the number of activities in this decomposition – 2;

Table 3.1

Component manufacturing process detailing

Process	Input	Output
1.2.1 – Converting semi-components into components	Semi-components	Completed components; Industrial waste
1.2.2 – Component quality control	Completed components	Completed components; Rejected product
The control arrows and the mechanism arrows indicated in the high level diagram should also be displayed in the detail diagram.		

5. Select the **IDEF0** diagram type (fig. 3.3) and click OK.

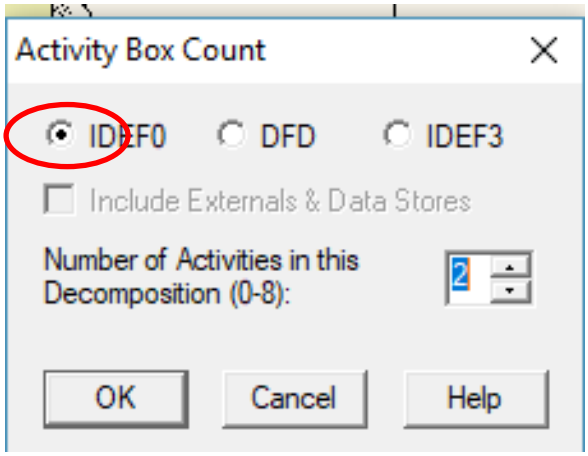


Fig. 3.3. The block decomposition dialog box

You will get the A2 level decomposition diagram (fig. 3.4).

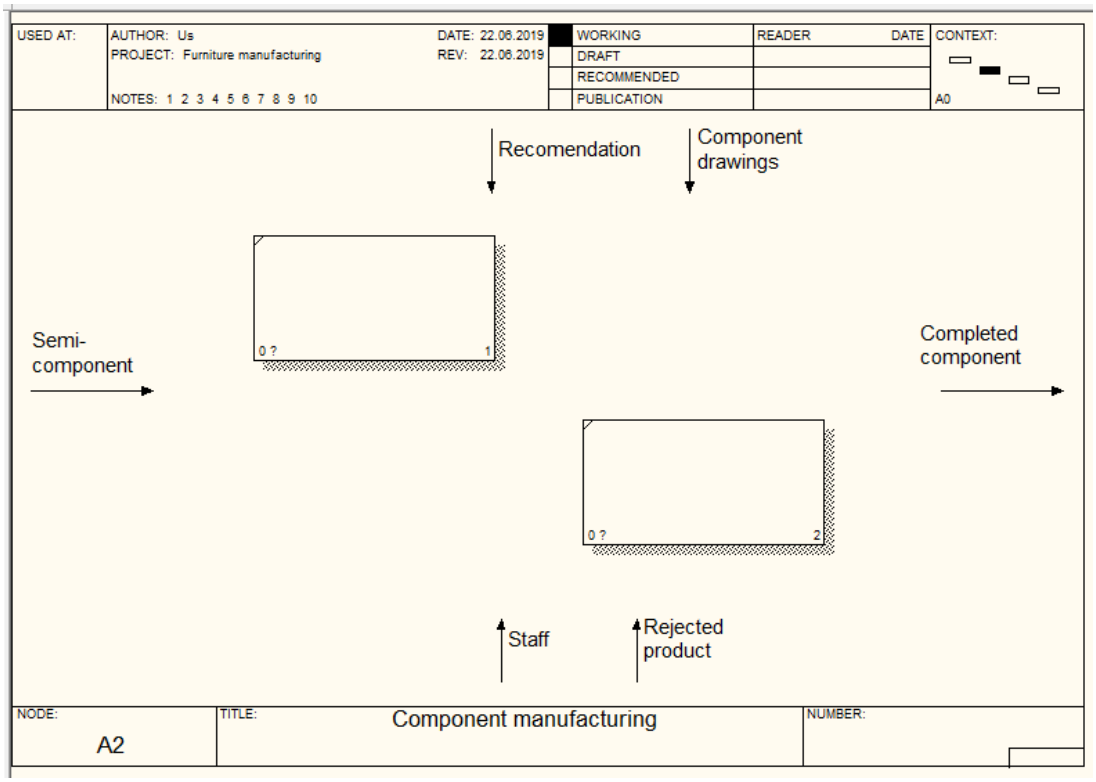


Fig. 3.4. A2 Level decomposition

6. Label (name) the processes;
7. Connect the processes with the arrows using information from the Table 3.1;
8. Check your work (fig. 3.5).

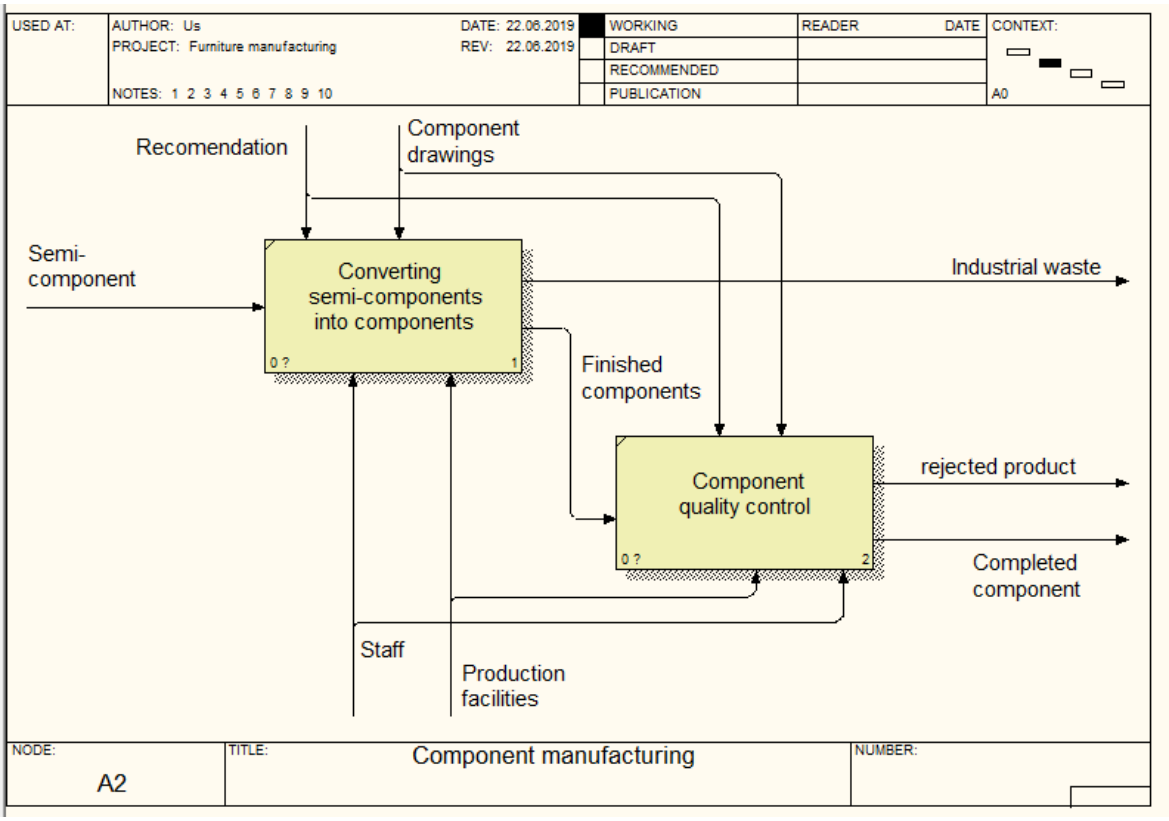


Fig. 3.5. ***Component Manufacturing*** *process detailing*

Task 19. Quality control process detailing

1. Detail the QUALITY CONTROL process independently.

When you complete this operation, the following diagram will be obtained (fig. 3. 6):

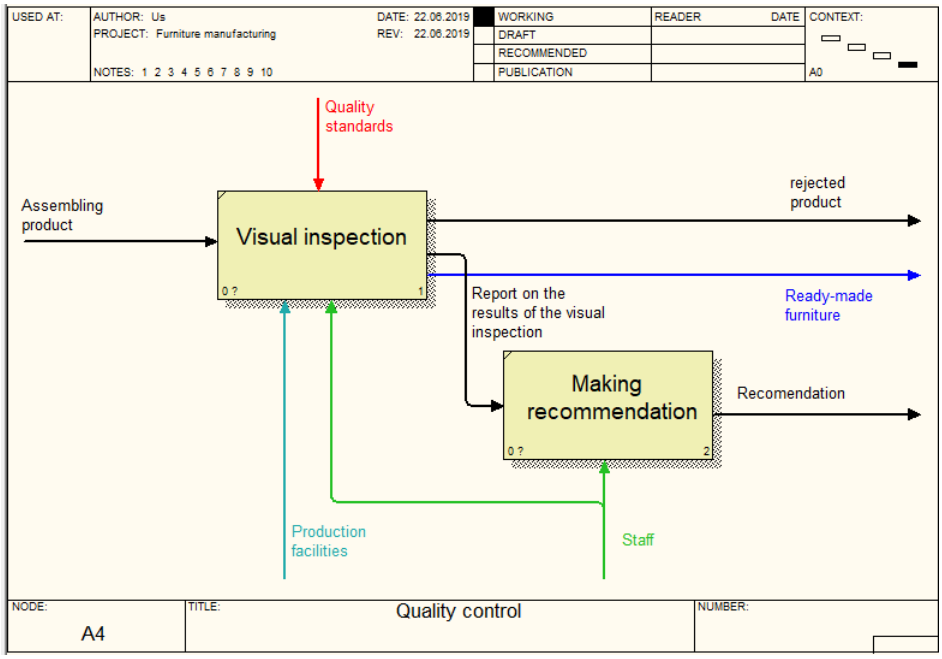


Fig. 3.6. ***Quality control*** *process detailing*

Task 20. Describing the model properties.

An **IDEF0-model** requires a clearly defined purpose, a single subject of modeling and one viewpoint. To include the scope, purpose, and viewpoint into the IDEF0 model in AllFusion Process Modeler 7.0, you should**:**

1. Select the menu tab **Model - Model Properties** which starts the dialog **Model Properties** (fig. 3.7);

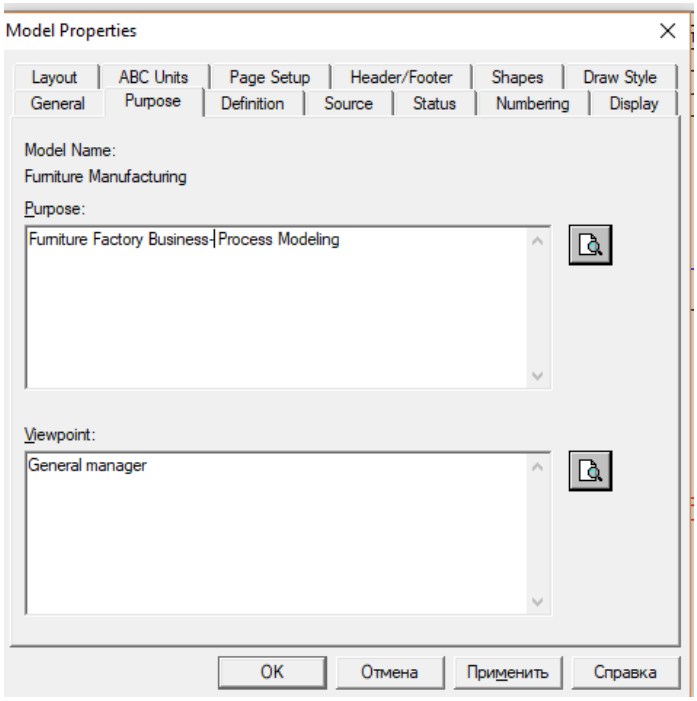


Fig. 3.7. The Model Properties Dialog

2. Add the purpose and the viewpoint to the **Purpose** tab, and the model definition to the **Definition** tab;

The purpose and viewpoint are accepted to be put in the context diagram **A-0** as a text block. They will appear in the context diagram as a text block after description. Description is made on the context diagram level.

To describe the purpose and viewpoint, you should:

3. Move on to the **A-0** level diagram.
4. Select the text button **T** .
5. Click on the position where you want the text to appear.
6. Type the text in the dialog window and specify its significance (normal text, purpose or viewpoint) (fig. 3.8).

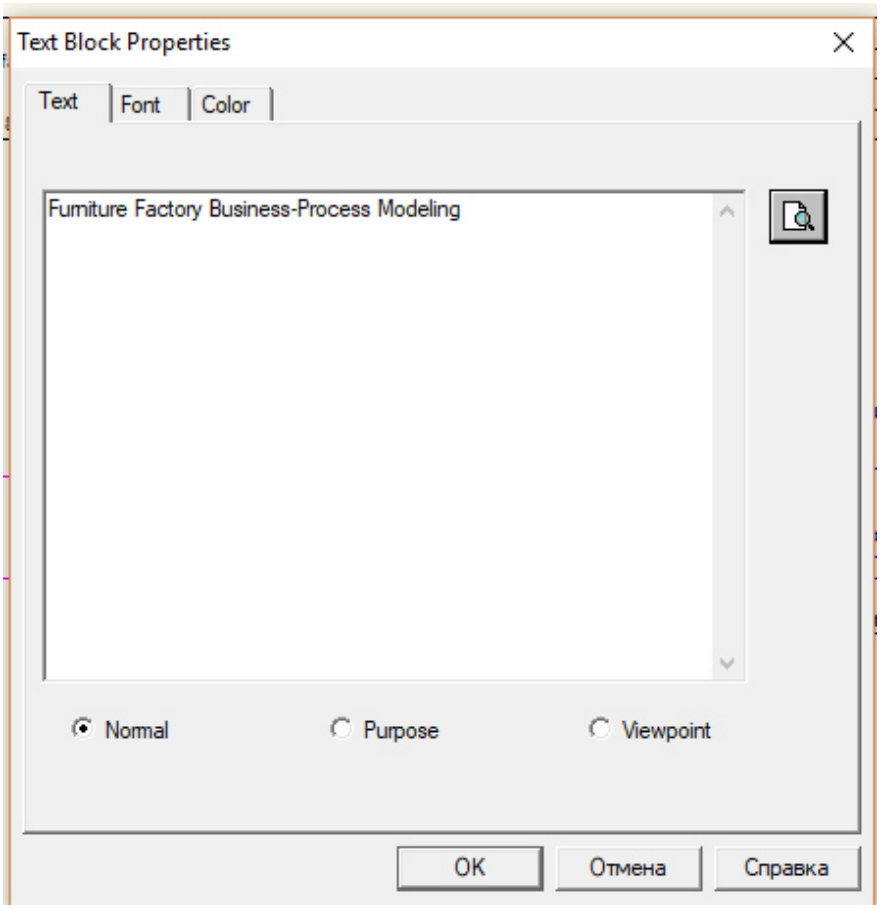


Fig. 3.8. Text block properties setting

7. Describe the model status (draft, working version, final version etc), creation date and the last revision date (being monitored automatically in future according to the system date) in the **Status** tab of this Dialog.

8. Describe the sources of information for model building (for example "Subject area expert poll and documentation analysis") in the **Source** tab.

9. The **General** tab serves for inputting the project and model name, the author's name and initials and the model time frame.

Task 21. Preparing the report.

You can get the result of the model description in the report option **Model Report**:

1. Start the dialog window of the model report setting in the menu **Tools – Reports-Model Report** (fig. 3.9).

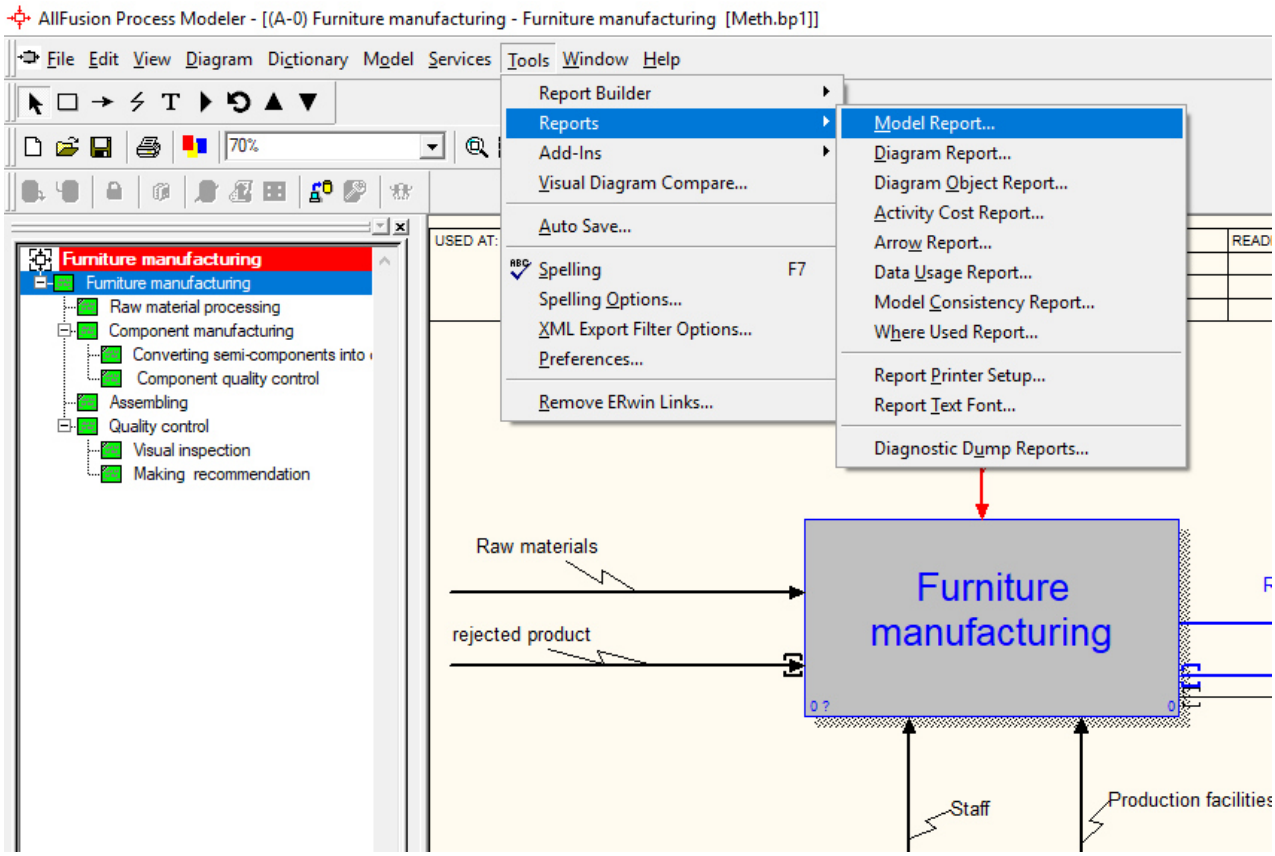


*Fig. 3.9. The menu **Tools – Reports – Model Report***

2. Select the required fields, wherein the data output order is automatically displayed in the report (fig. 3.10).

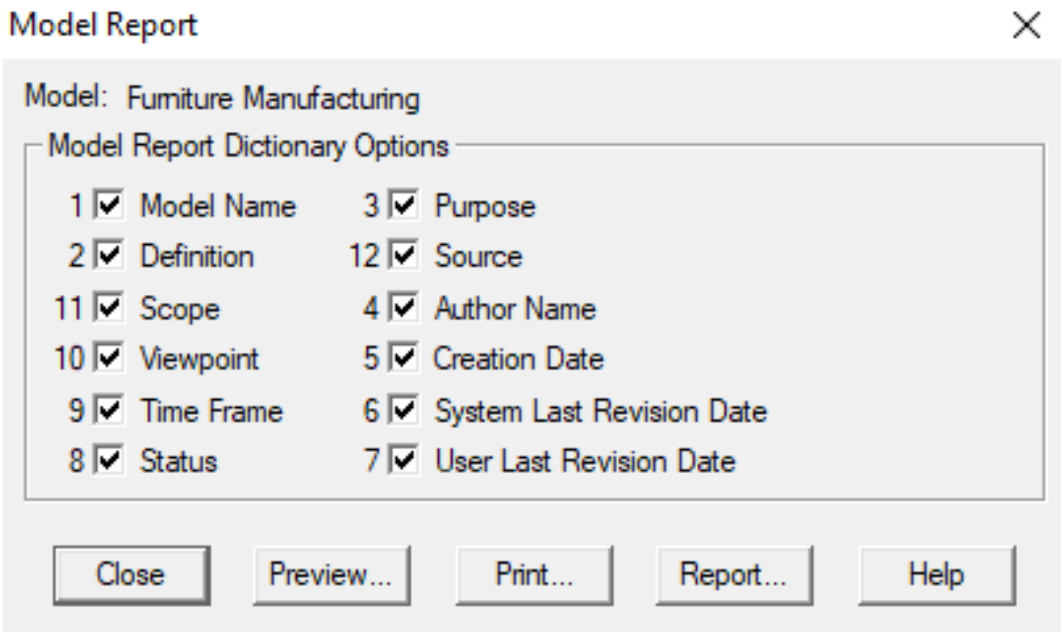


Fig. 3.10. The Model Report dialog box

3. Select the button **Preview** to look through the report (fig. 3.11).

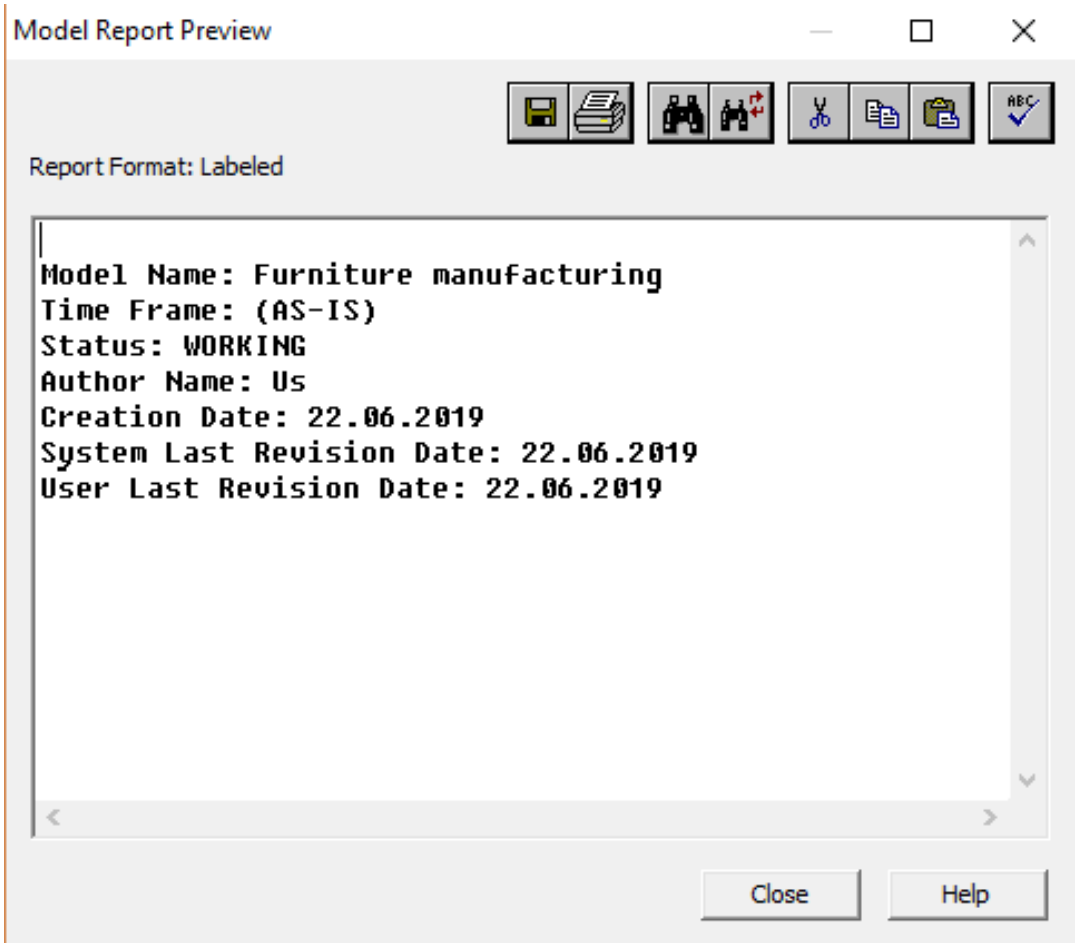


Fig. 3.11. Model report preview

PRACTICAL WORK № 4

CREATING A NODE TREE DIAGRAM and A FEO

THEORETICAL INFORMATION

Node tree diagrams and FEO

A node tree diagram shows the hierarchy of the activities in the model and allows the user to analyze the model as a whole. However, it does not specify the linkages between the activities (fig. 4.1).

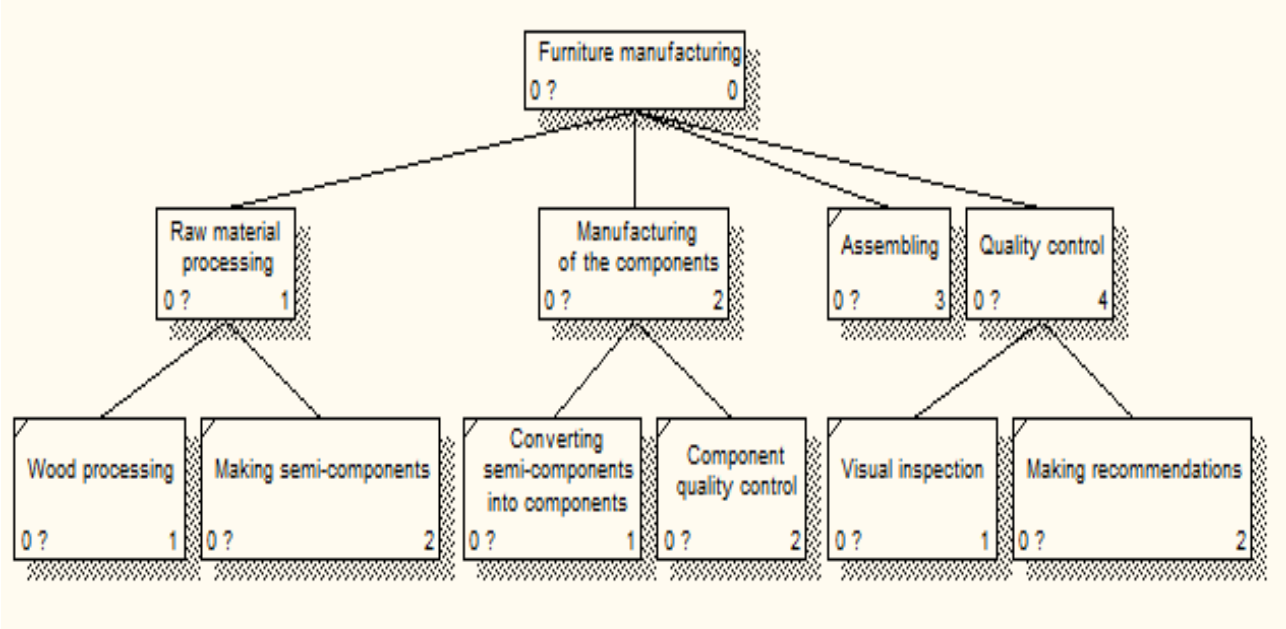


Fig. 4.1. A node tree diagram

The model creation process of activities is iterative (repetitive, repeatedly changing), consequently, activities can change their node tree location many times. In order not to get confused and check the way of decomposition, you should create a node tree diagram after every change. AllFusion Process Modeler 7.0 has a powerful tool of model navigation - **Model Explorer** (fig. 4.2), which allows you to present the hierarchy of activities and diagrams in a convenient and compact way, but this tool is not a part of the **IDEF0** standard.

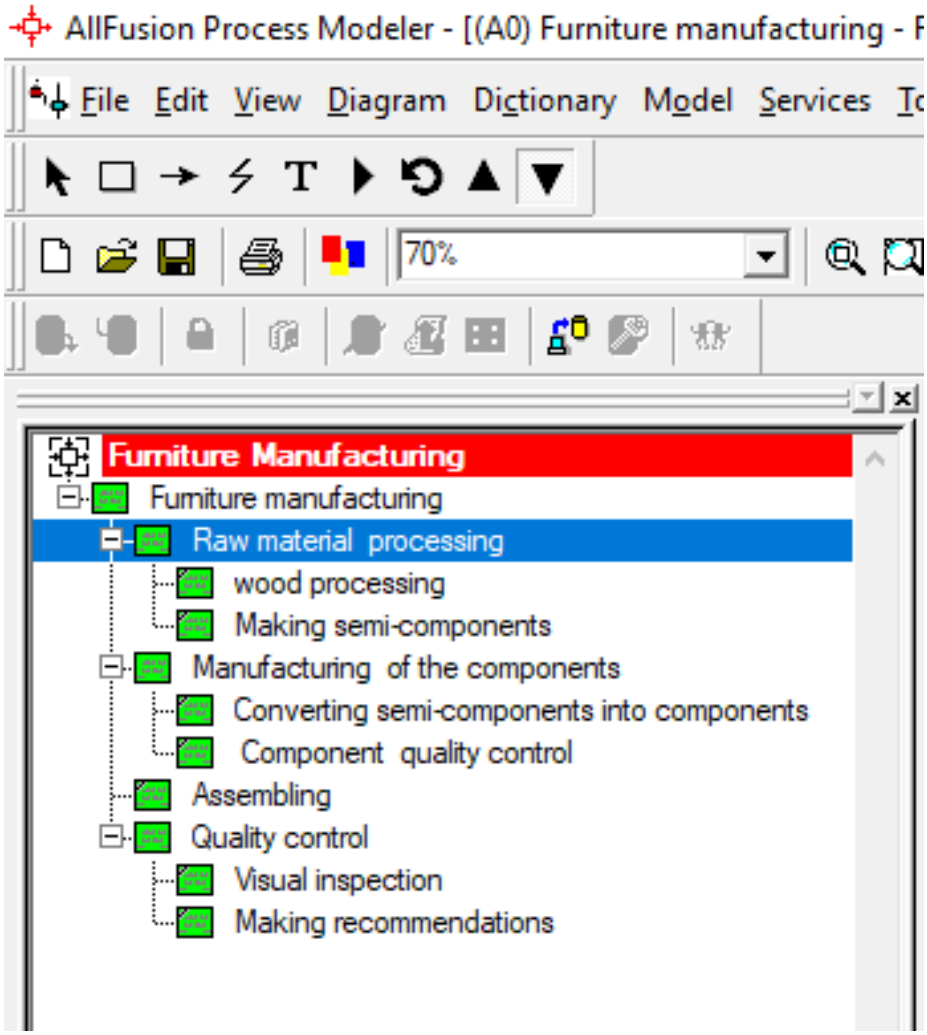


Fig. 4.2. Model navigator ***Model Explorer***

PRACTICAL TASK

Task 22. Creating a node tree diagram

To create a node tree diagram, you should:

1. Select the **Add Node Tree** option in the **Diagram** menu and run the **Node Tree Wizard** dialog to create a node tree diagram (fig. 4.3).

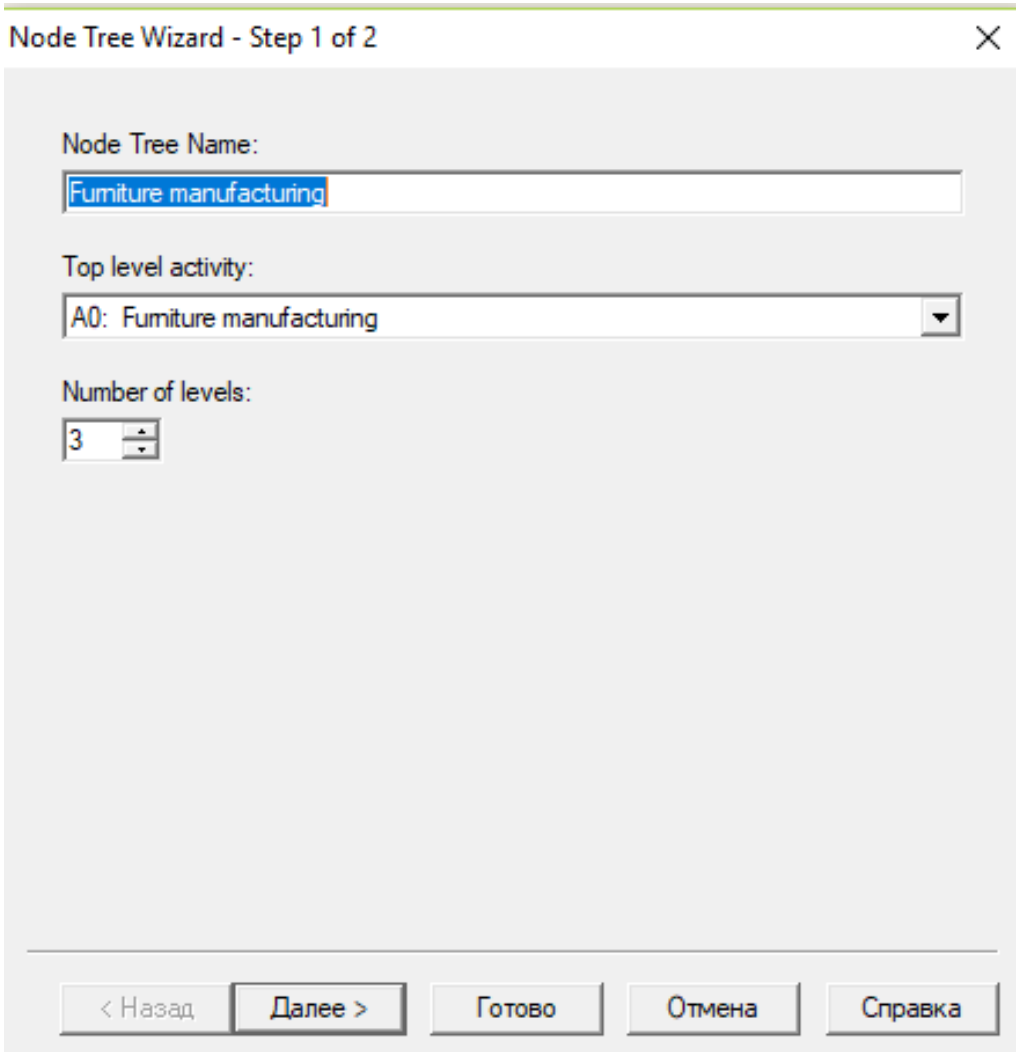


*Fig. 4.3. The **Node Tree Wizard** dialog box*

2. Type the *node tree name*, the *top level activity* and the *number of levels* (3) in the first expert dialog box.

It is not required for a node tree to have a context diagram as a high level diagram. It can also have an arbitrary number of levels. A big variety of node tree diagrams can be created for one model.

A node tree name is the same as the name of the high level diagram by default, and an automatically generated diagram number is also the same as the high level node number plus letter “N”, for example, A0N.

You can indicate the node tree diagram properties in the second expert dialog **Node Tree Wizard** (fig. 4.4).

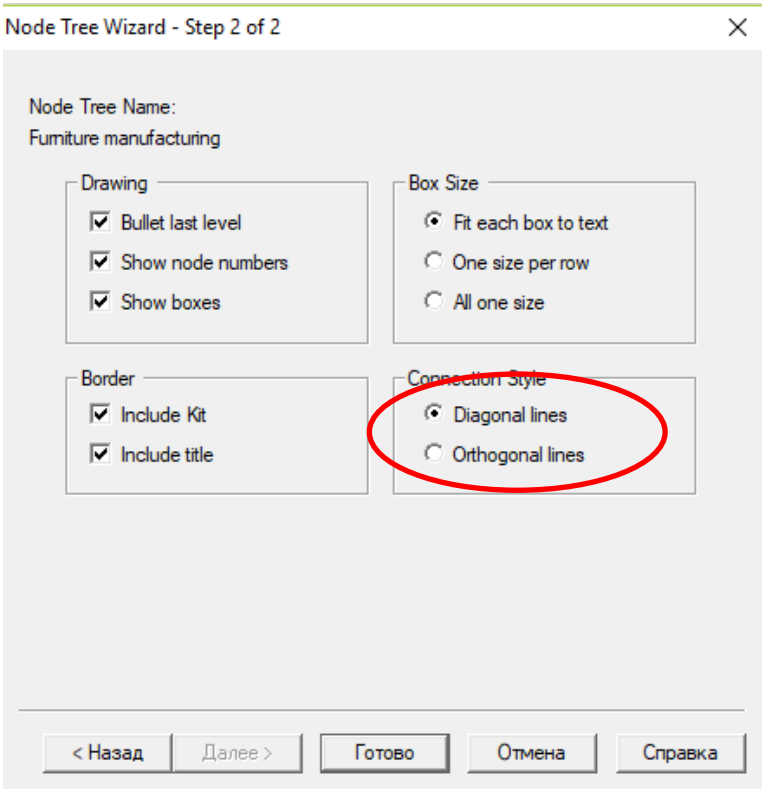


*Fig. 4.4. The **Node Tree Wizard** Expert Dialog*

A lower decomposition level is displayed as a list by default; other operations are presented in boxes. (fig. 4.5).

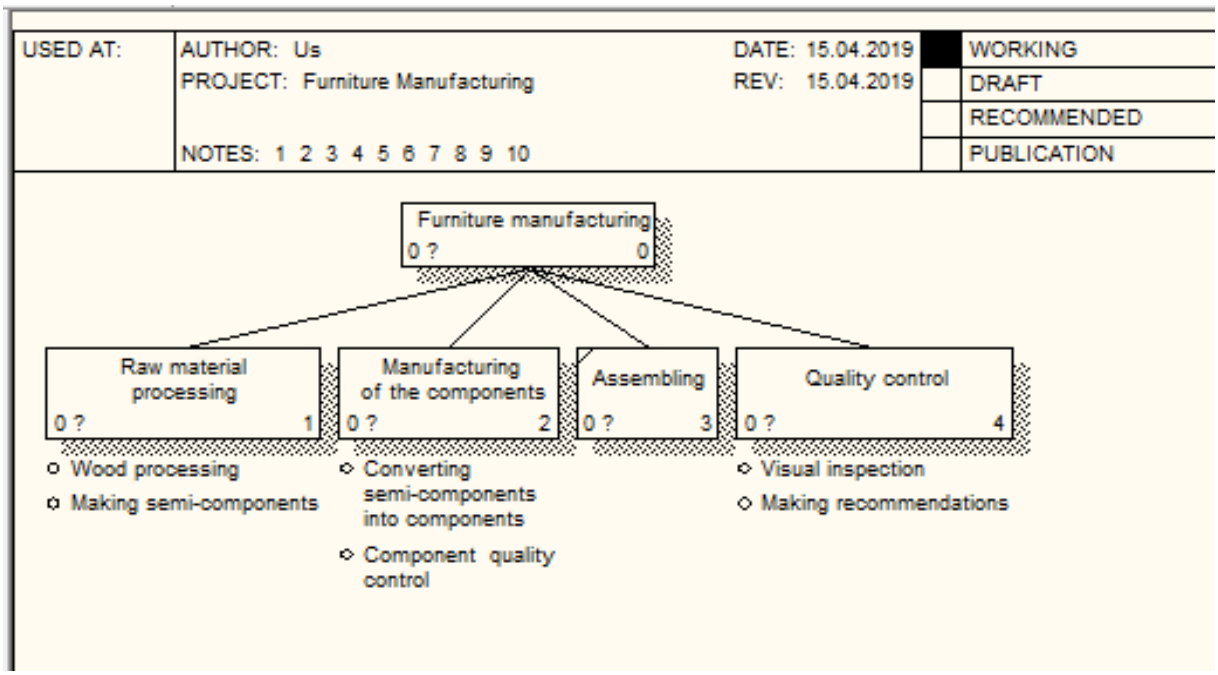


Fig. 4.5. A node tree with orthogonal lines

To display the whole tree in boxes, you should disable the option **Bullet Last Level**. The **Connection Style** group allows the user to select the line style – diagonal (by default) or orthogonal.

1. Click the right mouse button on any free space, and select the **Node tree Diagram Properties** menu (fig. 4.6).

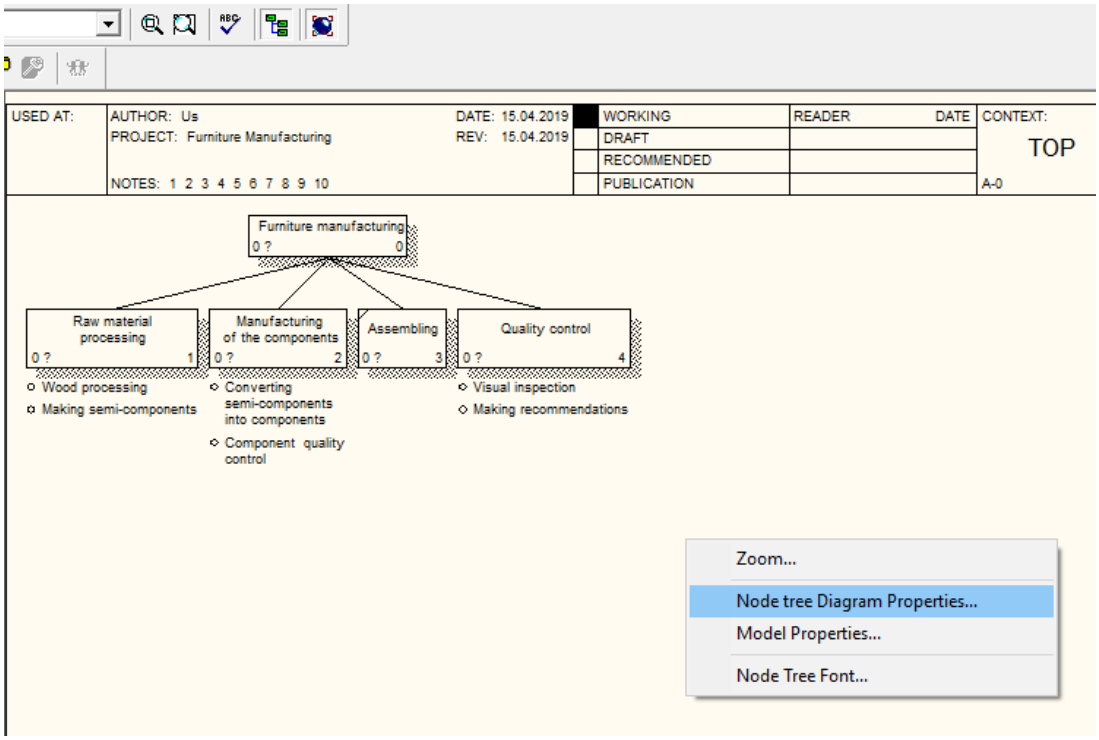
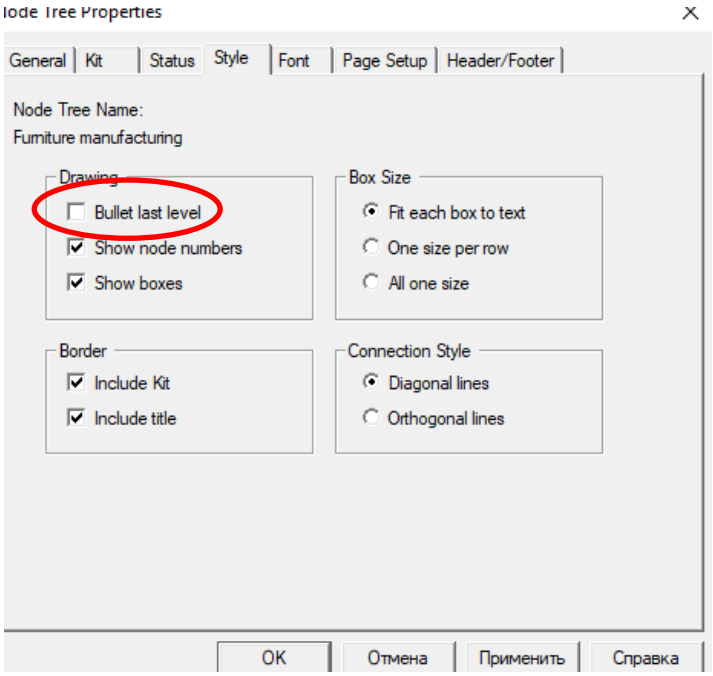


*Fig. 4.6. The **Node tree Diagram Properties** menu selection*

2. Disable the option **Bullet Last Level** in the **Style** tab of the **Node Tree Properties** dialog (fig. 4.7).



3. Click **OK.**
4. Check your results (fig. 4.8).

*Fig. 4.7. The **Node Tree Properties** dialog*

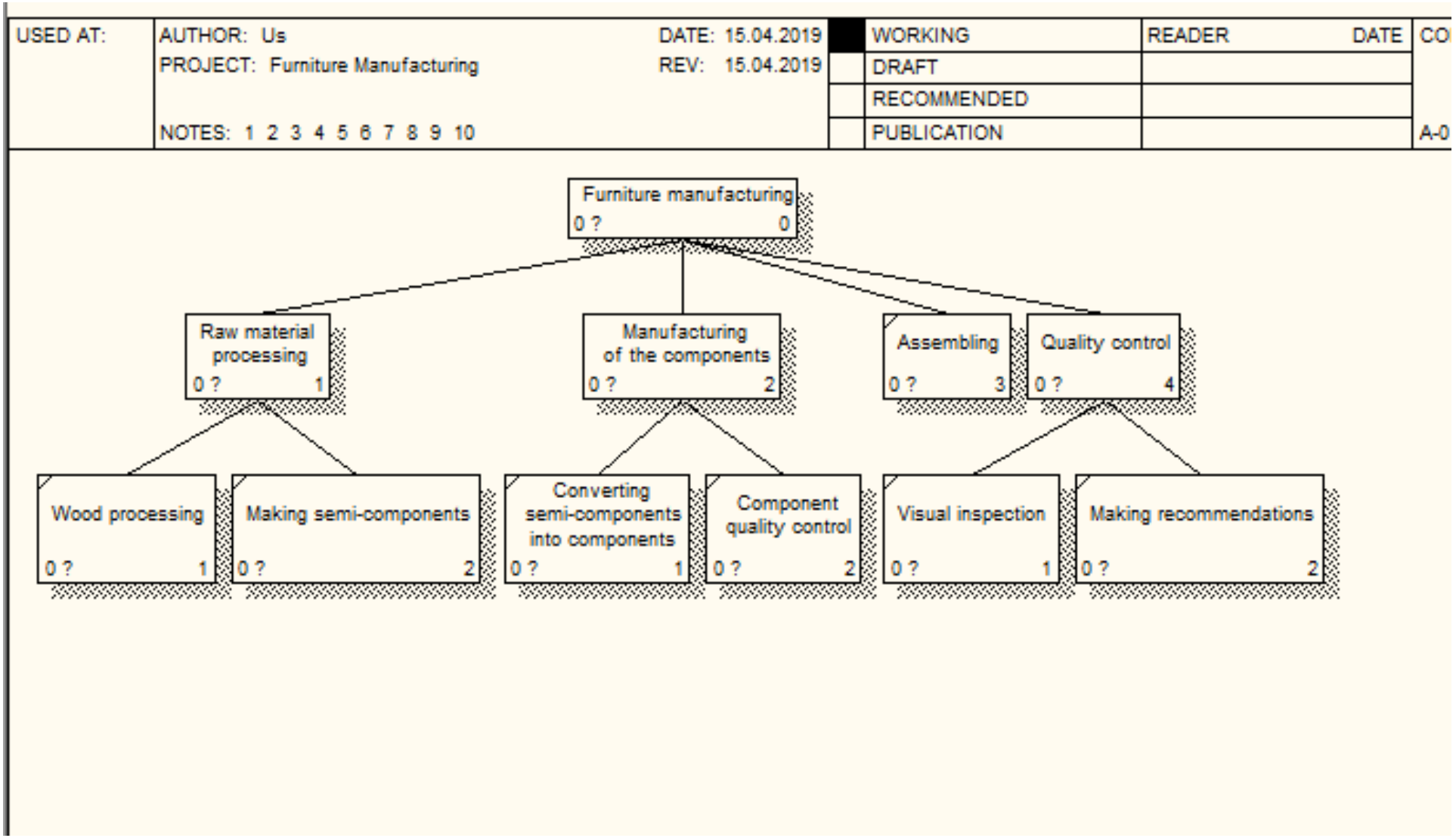


Fig. 4.8. A node tree

5. Create a node tree diagram with orthogonal lines for the COMPONENT MANUFACTURING process independently.
6. Check your work (fig. 4.9).

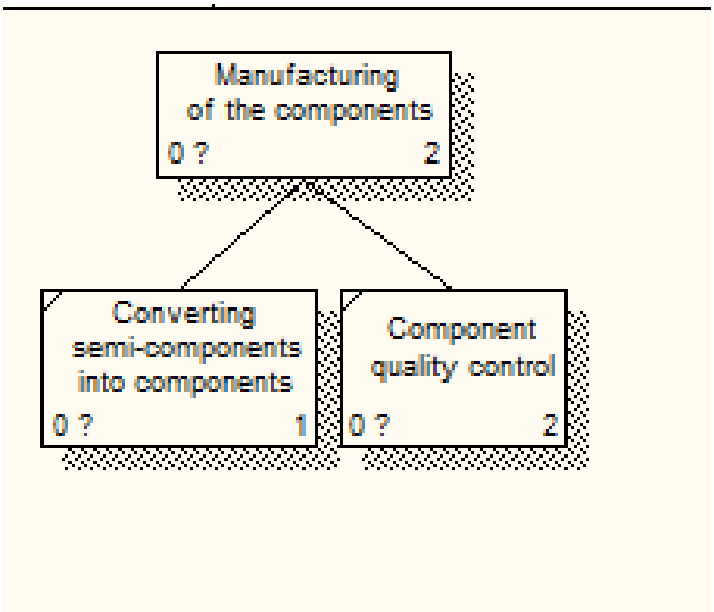


Fig. 4.9. The Component manufacturing process node tree

Task 23. Building a FEO diagram

FEO diagrams are often used in modeling to illustrate other viewpoints, and to show specific details that are not supported by the IDEF0 syntax. They are only pictures – the copies of standard diagrams – and not included into the syntax analysis.

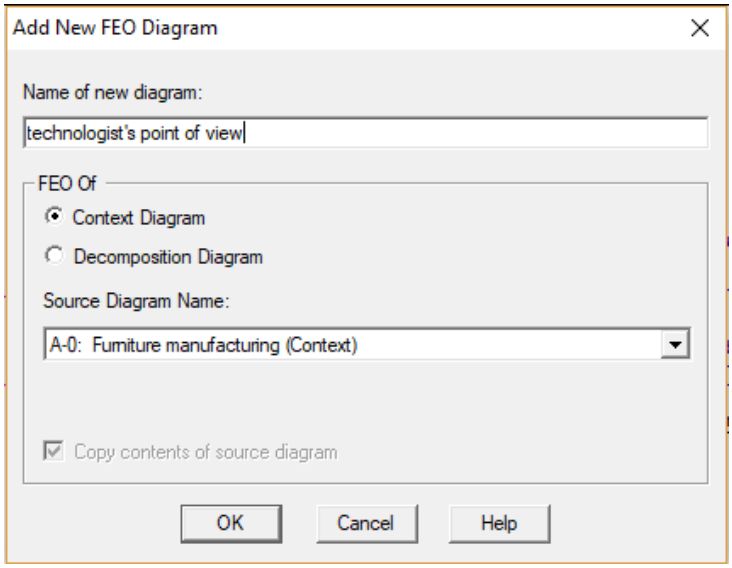


*Fig. 4.10. The **Add New FEO Diagram** dialog box*

Create a FEO diagram

1. Select the **Diagram - Add FEO Diagram** menu.
2. Enter the FEO diagram name and the type of a parent diagram (fig. 4.10).
3. Click **OK**.

You will obtain the following picture of the **Furniture manufacturing** context diagram. (fig. 4.11).

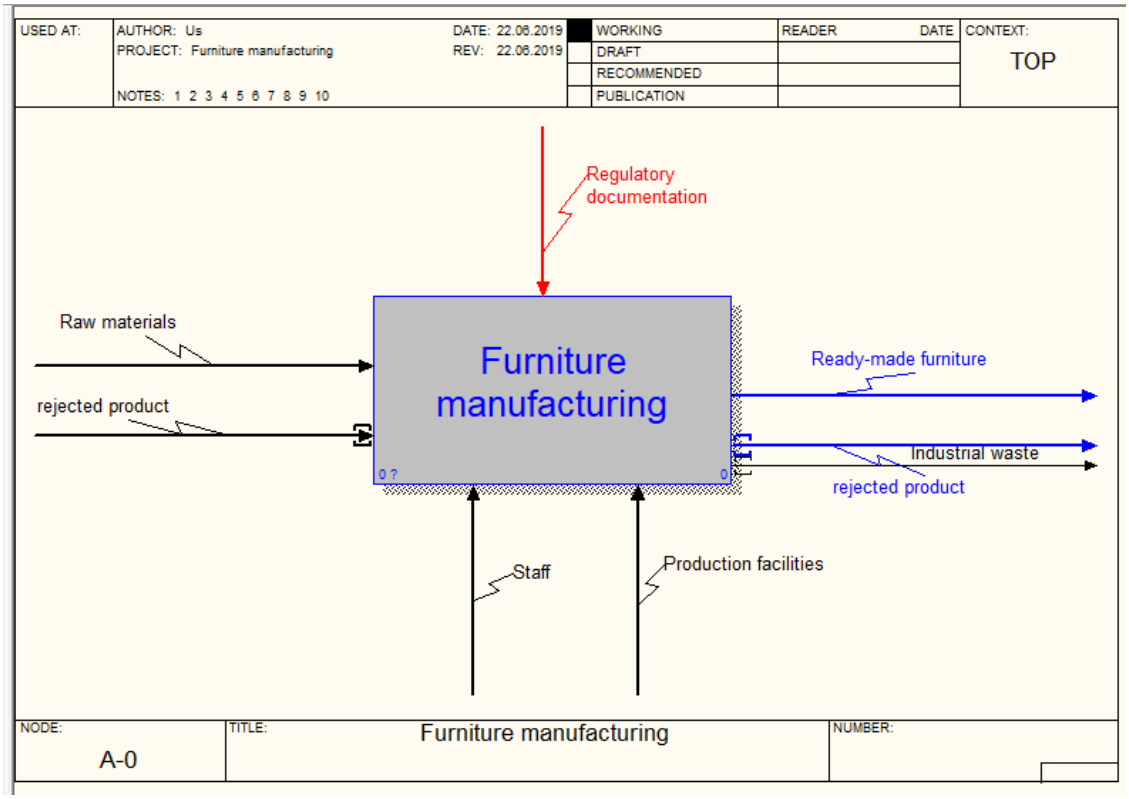


Fig. 4.11. The Furniture manufacturing context diagram picture

4. Create a FEO diagram for the QUALITY CONTROL decomposition diagram independently.
5. Check your results (fig. 4.12).

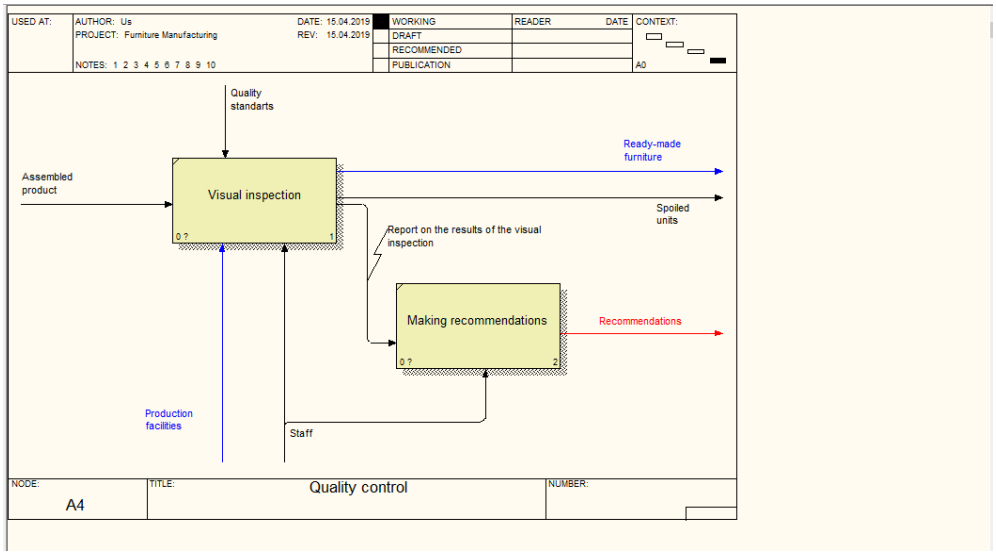


Fig. 4.12. The Quality control decomposition diagram picture

Task 24. Saving the diagram

1. In the **File** menu select **Save As**.
2. Specify the route to your folder and name the file **Lab3.bp1**.
3. Click OK.

TEST QUESTIONS

1. How are the models in the **IDEF0** hierarchy numbered**?**
2. Give the definition of a **node tree.**
3. What is functional decomposition in modeling?
4. How are the purpose and the viewpoint in a diagram specified?
5. What is a model report used for?
6. What is the purpose of a node tree diagram?
7. What properties and style can be indicated in a node tree diagram?
8. How many node tree diagrams can be created for one model?
9. What is a FEO diagram used for?
10. What is the difference between a node tree diagram and a FEO diagram?

TEST TASK

Continue the previous test task.

1. Open **Kr2.bp1** file.
2. Make a decomposition of two business processes.
3. Describe the model.
4. Create a node tree diagram for the context diagram indicating its name and the number of levels.
5. Create a **FEO** diagram.
6. Save you file in your folder with the name **Kr3.bp1**.

PRACTICAL WORK № 5

CONSTRUCTING A DATA FLOW DIAGRAM

With the help of this laboratory work you will be able:

- to construct a DFD – a data flow diagram;
- to make internal references;
- to detail a DFD diagram.

THEORETICAL INFORMATION

DFD Diagrams

You can use data flow diagramming as an addition to an IDEF0 model for a more accurate display of the current documentation operations in the information processing systems.

Data flow diagrams are used to describe a document flow and information processing. It is a model system that consists of the network of interconnected processes.

Data Flow Diagrams (DFDs) display external sources (entities) and data recipients, data flows and data stores, and access them.

A DFD describes:

1) information processing functions (processes);

2) documents (arrows), objects, employees or departments participating in the information processing;

3) external references providing an interface with the external entities outside the boundaries of the simulated system;

4) tables for document storage (data store).

The notation of Heine-Sarson is used to illustrate data flow diagrams in AllFusion Process Modeler 7.0 (Table 5.1).

The diagram construction steps

1. Select the external entities the system must be connected with.
2. Create a DFD high level diagram.
3. Make a functional decomposition of each sub-process using the low level diagrams.
4. Create a data dictionary.
5. Create the process specifications if it cannot be described with the combination of sub-processes.

Table 5.1

The notation of Heine-Sarson

Component	The notation of Heine-Sarson
data flow	Name →
control process	Number Name
data store	1 Name
external entities	Number Name

When you add an IDEF0 model to a DFD chart, new buttons appear in the tool bar of a new DFD diagram (fig. 5.1):

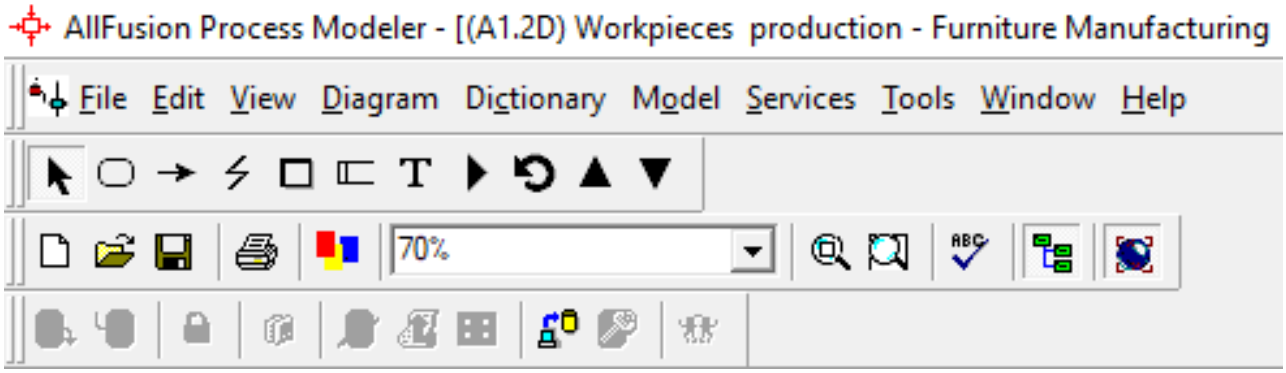


Fig. 5.1. The tool bar of a new DFD diagram

– Add an external reference to the diagram. An external reference is a source or a recipient of the data beyond the system.

– Add a data store to the diagram. The data store allows you to describe the data that you want to save in the memory before using it in the diagrams.

Unlike IDEF0, where the system is described as a set of interconnected diagrams, a DFD describes the system as a set of objects.

DFD processes are system functions that convert inputs into outputs. Although the processes are displayed in the boxes with rounded corners, their meaning is the same as the meaning of the processes in an IDEF0, they also have inputs and outputs, but they do not support controls and mechanisms like an IDEF0 (fig. 5.2).

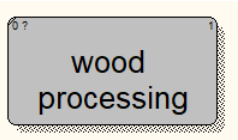


Fig. 5.2. A process description

External entities represent inputs to the system and / or outputs from the system. An external entity is displayed as a box with a shadow and it is usually drawn on the edge of the diagram (fig. 5.3). One external entity can be used repeatedly in one or several diagrams. Typically, this technique is used to avoid drawing long and confusing arrows.

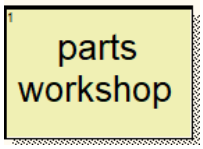


Fig. 5.3. External entity

Arrows (data flows) describe the movement of objects from one part of the system to another. The arrows can enter and exit any side of the box because sides do not have any specific functions in a DFD. Bidirectional arrows are also used in DFDs to describe command-response communication between processes, between the process and external entity, and between external entities (fig. 5.4).

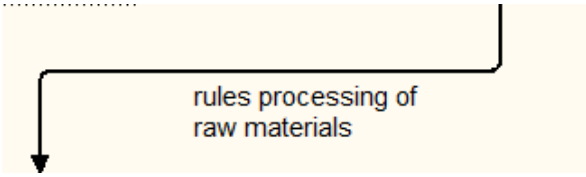


Fig. 5.4. Data flows (arrows)

A data store depicts inactive objects (objects at rest). In material systems, data stores are drawn where objects are waiting for processing, for example in a queue. In information processing systems a data store is a mechanism enabling to store data for subsequent processes (fig. 5.5).

Fig. 5.5. Data store

Unlike IDEF0 arrows, which demonstrate tight interconnections, DFD arrows show how the objects (including data) move from one process to another. This flow description, together with data stores and external entities, makes DFD models more

similar to the physical characteristics of the system - data flows, data stores, supply and distribution of external entities (fig. 5.6).

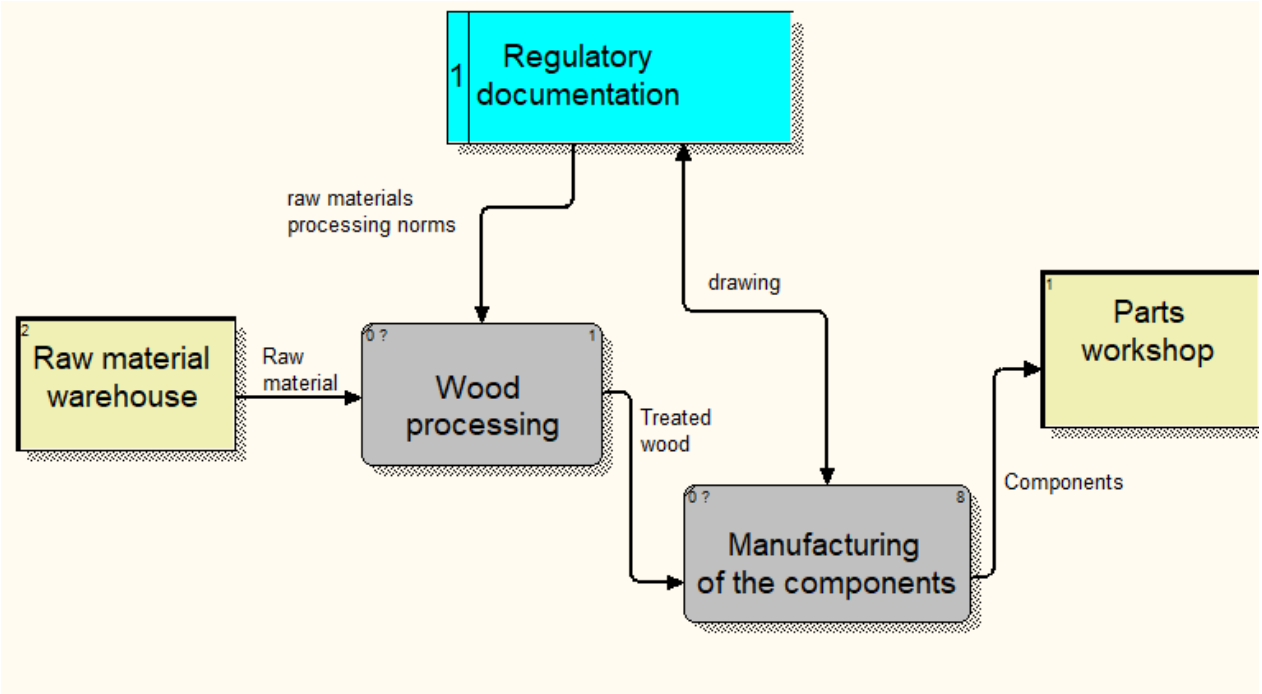


Fig. 5.6. Example of a DFD chart

PRACTICAL TASK

Let us make a model of the "Raw Material Processing" business process.

Task 26. Creating a DFD

1. Open the **Lab3.bp1** file saved at the previous lesson.
2. Select the tool ▼ and click on the **DFD** radio button of the **Activity Box Count** dialog during the process of the "Raw material processing" decomposition.
3. Select **2** in the number of decomposition activities of the **Activity Box Count** dialog box (fig. 5.7).

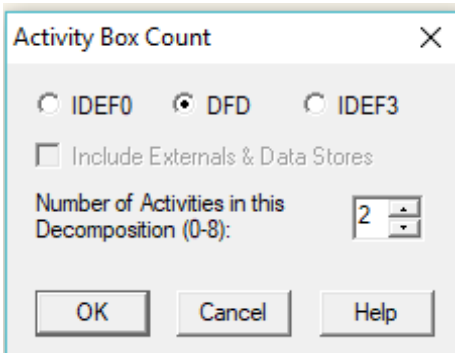


*Fig. 5.7. The **Activity Box Count** dialog box*

4. Click OK and type the names of the operations “Wood processing" and "Workpiece production" in a new diagram.

Task 27. Making external references

Follow these steps:

1. Using the button, enter external references.

2. Name the external references as “Raw material warehouse” and “Component manufacturing shop” in the **External Reference** dialog box (fig 5.8) and click OK.

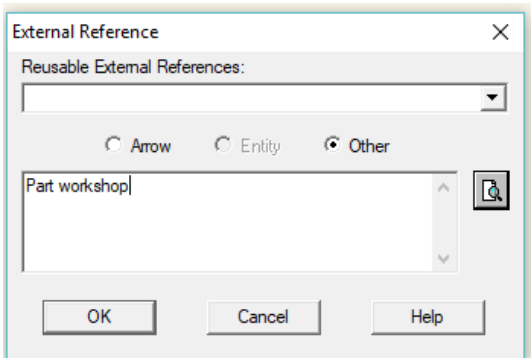


*Fig. 5.8. The **External Reference** dialog box*

When the task is completed, you will have the following diagram (fig. 5.9):

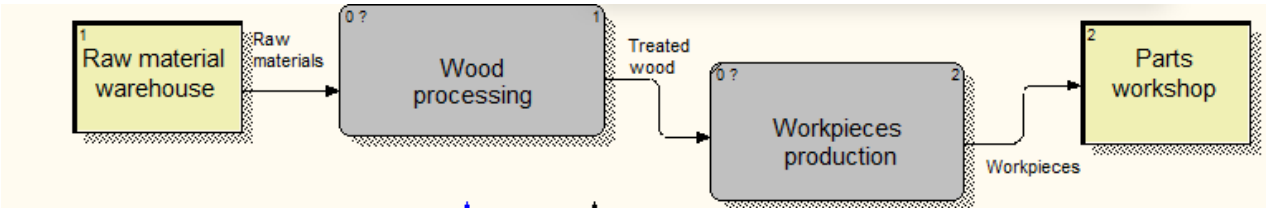


Fig. 5.9. External references

Task 28. Building data stores

1. Using the button on the tool bar, enter the "Regulatory documentation" (“Raw material processing standards”) data store (fig. 5.10).

2. Remove the boundary arrows from the diagram:

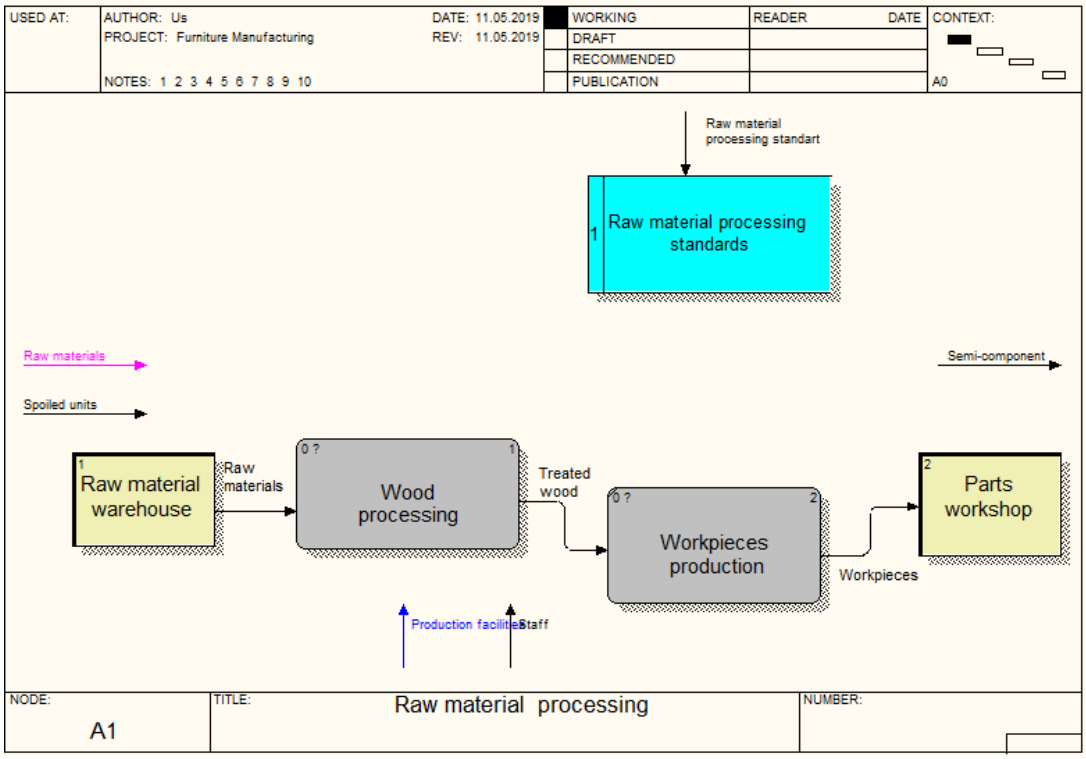


Fig. 5.10. A DFD Diagram

Task 29. Making internal references

1. Using the tool →, create internal references: "Raw material", "Wood processed"; «Workpieces», «Raw material processing standards», «Drawing».

2. To make the "Drawing" arrow bidirectional, click the right mouse button on the arrow line and select **Style** from the context menu.

3. Select the option **Bidirectional** in the **Arrow Properties** dialog box (fig. 5.11).

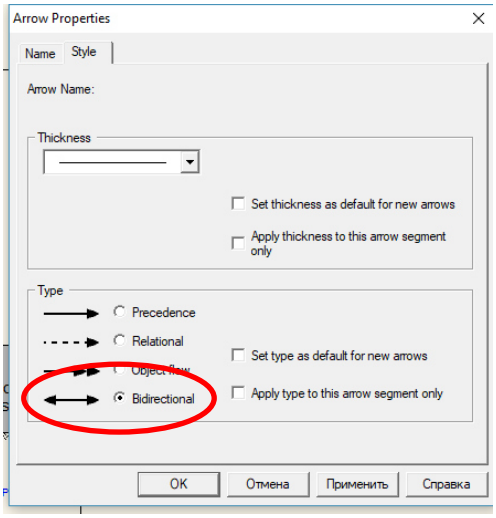


Fig. 5.11. The Arrow Style dialog box

4. Compare your diagram with fig. 5.6.

Task 30. Workpiece production process detailing

Detail the process of "Workpiece production" independently in accordance with the drawing (fig. 5.12).

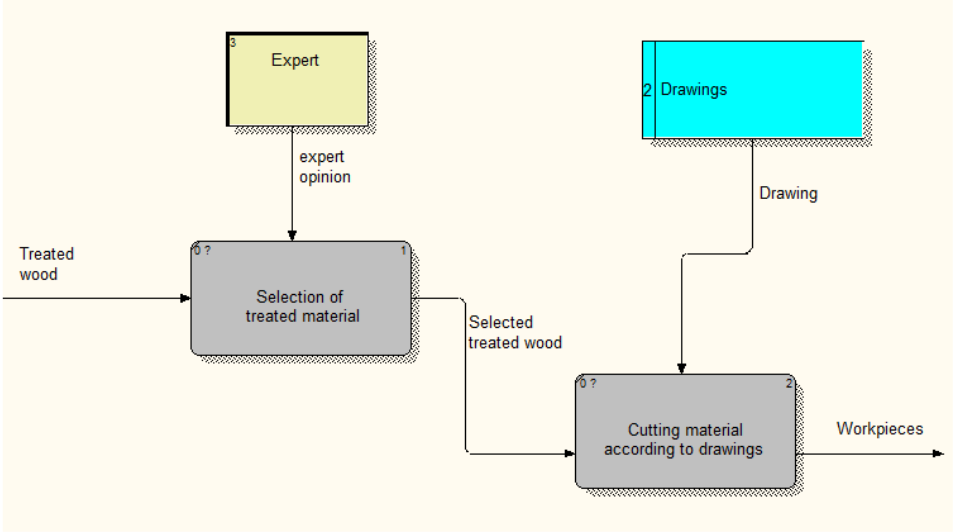


Fig. 5.12. Detailing the "Workpiece production" process

When the work is completed, you should demonstrate it to the teacher.

Task 31. Saving the diagram

Save the diagram.
1. In the **File** menu, select **Save as**.
2. Specify the route to your folder and name the file as **Lab4.bp1.**
3. Click OK.

After finishing this task, demonstrate the result to the teacher.

TEST QUESTIONS

1. What is a DFD used for?
2. What is the difference between a DFD and an IDFE0?
3. What tool is used to make external references?
4. What tool can be used to create a data store?
5. What graphic elements are used to draw Processes, Data flows, Data stores?

TEST TASK

Continue the completion of the test task.

1. Open the **Kr3.bp1** file.
2. Build a DFD diagram.
3. Detail the DFD diagram.
4. Name the file **Kr4.bp1** and save it in your folder.

LIST OF ABBREVIATIONS

Abbreviation	English	Ukrainian
ABC	Activity Based Costing	Процесно-орієнтоване управління витратами
CASE	Computer Aided Software Engineering	Технології автоматизованої підтримки розробки інформаційних систем
DFD	Data Flow Diagrams	Діаграма потоків даних (методологія моделювання потоків даних)
IDEF0	Integrated computer aided manufacturing DEFinition	Стандарт функціонального моделювання
IDEF3	Integrated DEFinition for Process Description Capture Method	Методологія моделювання і стандарт документування процесів
model AS – IS	Model of current organization of enterprise business processes	Модель поточної організації бізнес-процесів підприємства (як є)
model SHOULD – BE	Idealized model which does not reflect the real organization of business processes of the enterprise (as it should be).	Ідеалізована модель, що не відображає реальну організацію бізнес-процесів підприємства (як має бути)
model TO - BE	model of the future organization of business processes (as it will be)	Модель майбутньої організації бізнес-процесів (як буде)
SADT	Structured Analysis and Design Technique	Методологія структурного аналізу та функціонального моделювання
SWOT-analysis	Streight-Wetnesses-Opportunities- Treets	Метод стратегічного планування за 4 чинниками: сильних (Strengths) і слабких (Weaknesses) сторін проекту, можливостей (Opportunities) та загроз (Threats)
UOW	Unit of Work	Одиниця роботи

LIST OF TERMS

English	Ukrainian
Activity	Робота
Activity Based Costing	Звіт, побудований на основі затрат на операції
Activity Duration	Тривалість роботи
Activity Frequency	Частота роботи
Arrows	Стрілки
Asynchronous AND	Асинхронне « і »
Asynchronous OR	Асинхронне « або »
Auxiliary (Supporting) business processes	Допоміжні бізнес-процеси
Business-process (of)	Бізнес-процеси
– development	– розвитку
– management	– управління
Concomitant Business-process	Супутні бізнес-процеси
Consumers	Клієнти
Cost Center	Центр витрат
Critical Success Factors	Критичні фактори успіху
Data flow	Рух об’єктів
Data store	Сховище даних
Exclusive OR	Виключне « або »
External Reference	Зовнішнє посилання
Factors	Фактори
– external	зовнішні
internal	внутрішні
Fan-in Junction	Перехрестя для злиття стрілок
Functional approach to management	Функціональний підхід до управління
main (chief, operational, core, basic, primary) business processes	Головні бізнес-процеси
Object Flow	Потік об’єктів

Principle of labour division	Принцип розподілу праці
Process approach to management	Процесний підхід до управління
Providing (ensuring) business-processes	Бізнес-процеси забезпечення
Suppliers	Постачальники
Supporting business-processes (of)	Бізнес-процеси підтримки
Synchronous AND	Синхронне « і »
Value chain processes	Ланцюг додавання цінності

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МОДЕЛЮВАННЯ ПРОЦЕСІВ У НОТАЦІЇ IDEF0

МЕТОДИЧНІ РЕКОМЕНДАЦІЇ

ДО ВИКОНАННЯ ЛАБОРАТОРНИХ РОБІТ З ДИСЦИПЛІНИ

«МОДЕЛЮВАННЯ ТА РЕІНЖИНІРИНГ БІЗНЕС ПРОЦЕСІВ»

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