

BUSINESS SIMULATOR USERS MANUAL

Action Guideline 4:

Establishment/operation of a virtual lab based on the VET IT Tool - Support for the implementation of apprenticeships in enterprises

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Impressum

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Table of Contents

1.	Introduction	5
2.	Connection to the System	5
3.	Initial Screen	6
4.	Design Mode	7
	4.1 Creation of a New Design	8
	4.2 Main Design Screen	9
	4.3 Tool Bar	9
	Time Resolution	9
	Machines	.10
	Product	.12
	Carrier	.13
	Creation of Connections	.14
	4.4 Main Menu of the Design	.16
	Create A Version	.17
	Load Version	.17
	Create a Copy of a Design	.18
	Rename a Design	.19
	4.5 Test Mode	.19
	4.6 Open a Saved Design	.21
	4.7 View a Saved Design	.21
	4.8 Share Management Rights of a Saved Design	.22
	4.9 Delete a Saved Design or Version	.23
5.	Simulation Mode	.24
	5.1 Creation of a Simulator	.26
	5.2 Main Screen of the Simulator	.27
	5.3 Tool Bar	.27
	Simulation Time	.27
	Machines Schedule	.28
	Purchase Orders	.30
	Human Schedule	.31
	Sales Orders	.34
	5.4 Main Menu of the Simulation Mode	.35
	Perform a Simulation Run	.36
	Save Current Run	.36
	Load a Saved Run	.37
	Create a Copy of a Simulator	.37
	Rename a Simulator	.38
	Create Next	.39

Exit Simulator	40
5.5 Open a Saved Simulator	40
5.6 View a Saved Simulator	41
5.7 Share Management Rights of a Saved Simulator	41
5.8 Delete a Saved Simulator or Run	43
6. Results Mode	44
6.1 Main Menu of the Results Mode	46
6.2 Product View	46
6.3 Carrier View	49
6.4 Instant View	51
6.5 Incoming Stocks	53
6.6 Outgoing Stocks	54
6.7 Excess Production	55
6.8 Idle Machines	56
6.9 Idle Humans	56
6.10 View Design	57
7. Case Study: Modeling and Simulation of a Natural Juice Bottling Company	58
7.1 Overview	58
7.2 Create a Model	58
7.2.1 Operation Structure Analysis of the Company	
7.2.2 Products	59
7.2.3 Carriers	59
7.2.4 Machines	61
7.2.5. Model Design in Innovet Business Simulator	62
7.3. Create and Run a Simulation	67
7.3.1. Description and Objectives	67
7.3.2. Simulation	68
7.4. Analysis and interpretation of the Results	72
7.4.1 Show and Comment the Results	72
7.5. Conclusions	76
8. Appendices	77
8.1 First Educational Paradigm	77
8.2 Second Educational Paradigm	
8.3 Third Educational Paradigm	
8.4 Fourth Educational Paradigm	113
8.5 Fifth Educational Paradigm	
8.6 Sixth Educational Paradigm	

1. Introduction

The main objective of the software tool called Business Simulator is to promote better understanding of educational theories concerning the production process incorporated in a business environment. Moreover, these objectives entail business processes optimization and redesign, minimizing the cost of production through the minimization of the cost of materials, human resources and idle time due to inappropriate schedules and restructuring of orders and inventories in accordance with business needs.

For these reasons a process model is adopted according to which each trainee is acquainted with the most significant business operations and processes of the various departments and becomes capable of identifying business weaknesses faster and more efficiently. In conclusion, trainees acquire administrative decision skills concerning business operations and processes for the future optimization of the economic organizations they are employed by.

The **Business Simulator** tool is a web-based free software tool developed under the InnoVET project funded by the Erasmus + Program. In order anyone to have access to the **Business Simulator** tool, he/she should contact the Project Coordinator via the e-mail address innovet@teiemt.gr in order to be granted access credentials (username & password). This manual first describes the functions of the **Business Simulator** tool and then provides training examples of how to use the tool in predetermined business processes.

2. Connection to the System

Using the address <u>http://innovet.teiemt.gr/bs</u> through a **google chrome browser** the user acquires access to the initial screen of the tool.

INNÓVET	
Log In to Your Account	
Username	
Password	
Log In	
Co-funded by the Erasmus+ Programme of the European Union	

On this screen, the user is typing the provided credentials and clicks the *Log In* button to enter into the system.

3. Initial Screen

After the successful entry into the system, the following screen appears which displays the three main operations of the tool: **Design Mode**, **Simulation Mode** and **Results**.

INNG	∕ЕТ	Business Simulator			Ⅲ ⑦· ▲	~
١	Welcon	ne to Innovet Busines	ss Simulator v1.0			
-						
		Design Mode	Simulation Mode	Results		
		Help		About		

• Design Mode

The **Design Mode** provides the user with the ability to crate and experiment new or existing designs.

• Simulation Mode

The **Simulation Mode** button is the simulation startup tool and provides the user with options for adjusting the production schedule, workforce (people), machines, sales and orders.

• Results

In the **Results** button, as the name implies, are presented the various simulation results such as machine and human idle time, material usage, production schedules, sales, etc.

4. Design Mode

The main menu of the **Design Mode** includes the following items:

≡		Business Simulator		? ~	💄 User1 🗸	•
Ľ	Design Mode New					
ß	Open					
۲	View					
\$	Share					
Ē	Delete					
						•
4					•	

• New

The **New** button allows the user to start the creation of a new Design.

• Open

The **Open** button allows the user to open an existing Design, either own or shared.

• View

The **View** button provides the user with the ability to view and control an existing Design.

• Share

The **Share** button allows the user to assign managements rights of the Designs to other users.

• Delete

The **Delete** button allows the user to delete a saved Design that is created at earlier time. A shared Design may not be deleted by a user who has been granted access while it is created by other users.

4.1 Creation of a New Design

New Design		×
Name	test1	
Time Resolution	uay	
	ок	Cancel

Click the New button in the Design Mode and a window named New Design appears.

In the field **Name**, the user defines the name of the new Design.

In the field **Time Resolution**, the user can adjust the discrete interval between 2 consecutive process steps of the Design. The field values are set in seconds, minutes, hours, days or weeks.

The creator of a Design is the only person who has rights to this particular Design and these rights can be assigned or shared with other users via the **Share** button in the menu of the **Design Mode**.

[®] In the field **Name** set *test1* and in the field **Time Resolution** set *day* and click **OK**.

Upon completion of this action, the user enters the Main Design Screen of the Design test1.

4.2 Main Design Screen

≡ INN(DET Business Simulator	🗰 🕐 🔺 User1 ~
Design Mode		
Load Version	Design: test1 Design: test1	
🖺 Save Version		
🖆 Сору		
💉 Rename		
▶ Test		
← Close		
•		•

The Main Design Screen is divided in three areas. On the left side of the screen is the Main Menu of the **Design test1**, in the center there is a tool bar 🕐 🗱 🔀 and underneath, there is a design surface.

 Design: test1 Moreover, the name of the Design appears in a blue frame.

4.3 Tool Bar

Time Resolution



The first button in the tool bar is **Time Resolution**. Here, the user has the ability to modify the **Time Resolution** defined during the creation of the **Design**.

[®] Set as **Time Resolution** *hour* and press **OK**.

Time Resolution		×
Time Resolution	hour	v
		OK Cancel

A message appears that informs the user in case of existing **Machines** in the **Design**, these **Machines** should be adjusted in terms of the new **Time Resolution**.

[®] Press **OK.**



Machines



The second button in the tool bar is **Machine**. Press the **Machine** button. A window appears in which the user can set the name of the machine, the number of inputs-outputs, the minimum time between two consecutive inputs, and the number of humans required

for the operation of the machine (in case of no human requirements, set zero value).

Insert Machine	×
Machine Name Inputs Outputs Next Input Time Required Humans	1 ▼ 1 ▼ hour(s)
	OK Cancel

© Create one Machine named *mach1*, with 2 inputs, 1 output, Next Input Time 2 hours and required personnel 1 human.

Insert Machine		×	
Machine Name Inputs Outputs Next Input Time Required Humans	mach1 2 ▼ 1 ▼ 2 1	hour(s)	
		ОК Cancel	

[®] Press **OK**.

A Machine named *Mach1* is created on the design surface. The user is capable, with the Drag & Drop function, to transfer the Machine anywhere on the design surface.

Design Mode Design Mode Design: test1	
Save Version	
Copy	
Rename	
▶ Test	
← Close	
	•

With right click on the Machine *Mach1* a window named **Update Machine** appears which allows the user to **Update** the features of the Machine or even to **Delete** the Machine.

[®] Click the right button of the mouse on the Machine *Mach1*.

Update Machine		×
Machine Name Inputs Outputs Next Input Time Required Humans	mach1 2 V 1 V 2 1.00	hour(s)
	Update	Cancel Delete

[®] Press Cancel.

Product

All the relevant raw materials and finished and semi-finished products have to be created in each Design. The fourth button in the tool bar is **Product**. Press the **Product** button. A window named Manage Products appears which allows the user to define the name of each product/raw material, unit values (i.e. kgr, minutes, meters, data etc). A product is introduced

in a **Design** by pressing the **Add** button.

Manage Products		×
Add Product		
Name	Unit	Actions
pro1	Kgr	Add
Name ^	🔺 Unit	Actions
	No data available in tab	le
Showing 0 to 0 of 0 entri	es	Previous Next
		Close

[®] Create three **Products** named pro1,pro2 & pro3, with unit values Kgr for all.

Manage Products				×
Add Product				
Name	Unit			Actions
				Add
Products				
Show 10 V entries	Searc	h:		
Name ^	Unit		Ac	tions 🔶
pro1	Kgr		Modi	fy Delete
pro2	Kgr		Modi	fy Delete
pro3	Kgr		Modi	fy Delete
Showing 1 to 3 of 3 entries		Previo	us	1 Next
				Close

Moreover, the user can delete/modify a product with the use of the corresponding **Delete/Modify** buttons.

[®] Press **Close**.

Carrier



In order to store, to transfer, to input/output products from one machine to another, the **Carriers** are employed. The third button in the tool bar is **Carrier**.

[®] Press the **Carrier** button.

A window appears in which the user must define the name of the product, the **Carrier** transfers and set the **Initial Amount** of the product in the **Carrier**, the **Maximum (Max) Amount** of the product in the **Carrier** and the **Line Color** that identifies the particular **Carrier**.

[®] Press **OK** to create the **Carrier**.

Insert Carrier		×
Product to carry Initial Amount Max Amount Line Color		
	OK Canc	el

[©] Create three **Carriers** with the following features:

Product to Carry pro1, Initial Amount 10, Max Amount 100 and Line Color red,

Product to Carry pro2, Initial Amount 5, Max Amount 100 and Line Color blue,

Product to Carry pro3, Initial Amount 0, Max Amount 100 and Line Color green.

≡ INNØV	ET Business Simulator	📰 🕐 🔺 User1 ~
Design Mode	O Design: test1	
🖺 Save Version	1598-pro1 1600-p	ro3
街 Сору	• mach1 0/100	5
🔊 Rename	5/100	
▶ Test		
← Close		
•		• •

Creation of Connections

Connection is the matching of one input/output of a **Machine** with a **Carrier** and it is created through the round pads of input/output of the **Machine**.

With a click on the right button of the mouse on an input pad, a window named **Update Machine Pad** appears. In the field *Connected With* the user can define the *Carrier* with which the machine will be connected and in the field *Amount to input* the user defines the quantity of the product that is imported to the machine, each time the machine imports products.

Update Machine Pad		×
Connected with Amount to input	▼	
	Update Cancel De	lete

With a click on the right button of the mouse on an output pad, a window named **Update Machine Pad** appears. In the field *Connected With* the user can define the *Carrier* with which the machine will be connected, in the field *Production time* the user defines the required time for the production of a product, in the field *Initial state* the initial state of the machine is set (the stage of product development at the beginning of the simulation – zeros in case of non-existent work in progress) and in the field *Production amount* the quantity of the product produced is defined.

Update Machine Pad		×
Connected with		•
Production time	0	hour(s)
Initial state	null	0 bits
Production amount	0	
	Update	Cancel Delete

In order to match the **Carriers** with the **Machine** click on the right button of the mouse on the input/output pads of the **Machine** and adjust the following parameters:

- In the first input of the **Machine**, in the field *Connected With* the *Carrier* of pro1 and in the field *Amount to input* set value 1 and then press the *Update* button.
- In the second input of the **Machine**, in the field *Connected With* the *Carrier* of pro2 and in the field *Amount to input* set value 1 and then press the *Update* button.

• In the output of the **Machine**, in the field *Connected With* the *Carrier* of pro3, in the field *Production time* set value 1, in the field *Initial state* set value 0 and in the field *Production amount* set value 1 and then press the *Update* button.

≡	INNGV	ET Business Simulator	 ? ~	💄 User1 🗸	•
123	Design Mode	O Design: test1			
6	Save Version	1598-pro1			
ආ	Сору	0/100			
A	Rename	5/100			
►	Test				
←	Close				
•				•	•

4.4 Main Menu of the Design

The main **Menu** of the environment of the **Design**, is presented in the following section:



Load Version: Load of a saved version of the Design.
Save Version: Save the current version of the Design.
Copy: Copy the current Design with another name.
Rename: Rename the current Design.
Test: Start the test state of the current Design.
Close: Exit from the Design.

Create A Version

[®] Click on the **Save Version** button, type *ver1* and press **OK**.

Version Description	×
Write a short Description for the New Version	
ver1	
ОК Саг	ncel

With the preceding action, the user creates a copy of the current state of the Design test1 named ver1. That copy belongs to the Design test1 and it is referred as a version of that particular Design. The user is able to continue working in the environment of the Design while the state of the saved version remains unaffected.

The user can upload in the environment of the Design, at any time, any version of the Design that has been saved at an earlier time.

Load Version

[®] Click on the **Load Version** button. The following warning window appears which informs the user that in case of loading a version, all the objects of the current Design will be lost.



[®] Press **OK**.



[®] Select *ver1*.

With the preceding action, the user loads the saved version *ver1* of the Design test1 in the work environment.

Create a Copy of a Design

[®] Click on the **Copy** button. Type test2.

With the preceding action, the user creates a copy of the current Design named test2.

Copy to a	New Design ×
Name	test2
	OK Cancel

[®] Press **OK**.

INNOVET

	 ? ~	Luser1 ∽	•
Design Mode Load Version			
Save Version 1598-pro1			
Copy 1599-pro2			
S/100 5/100			
▶ Test			
← Close			
			•

Rename a Design

[®] Click on the **Rename** button. Type test3.

With the preceding action, the user renames the current Design named test2 to test3.



[®] Press **OK** and then press **Close**.

4.5 Test Mode

The **Business Simulator** allows, with the **Test** function, the user to perform a quick check of the Design for design inefficiencies.

- [®] Press **Open** and select *test1*.
- O Press Test.

The user is transferred in a new Test Mode environment.



In this environment, a test tool bar and the blue frame Time appear.



In the initial state of the Test, time is zero and the **Carriers** exhibit the values defined during the designing process of the Design. The **Step Forward** button launches the simulation and the Design is transferred in time 1 (as it is defined previously in the field **Time Resolution**) while a second press of the button transfers the Design in time 2 etc. Simultaneously, the new values of the objects appear in the Design. Particularly for the **Machines**, the stage of product development appears thoroughly in each output of the **Machines**.

The **Step Backwards** button allows the user to transfer the Design in a preceding time of the simulation.

The **Play** button allows the user to launch the simulation process while the **Pause** button that appears allows the user to pause this process.

The **Reset** button allows the user to reset the Design to its initial state of the Test.

The **Close** button allows the user to exit from the Test Mode environment.

O Press × to exit from the Test Mode environment.

[®] Press **Close** to exit from the environment of the Design.

4.6 Open a Saved Design

Click on the *Open* button in the menu of the **Design Mode** and a window named **Open Design** appears.

Open Desig	ı		×
<pre>test1</pre> test3	owner: user1 owner: user1	(23/01/2019 14:20) (23/01/2019 18:09)	
			Cancel

[®] Select the Design *test*3.

[®] Press **Close** to return to the main menu of the **Design Mode**.

4.7 View a Saved Design

The **View** button allows the user to view an existing Design. Click on the **View** button and a window named **View Design** appears.



[®] Select the Version *ver1* of the Design *test1*.

[®] Press **Close** to return to the main menu of the **Design Mode**.

4.8 Share Management Rights of a Saved Design

The **Share** button allows the user to share management rights to the Designs, with other users. Click on the **Share** button and a window named **Share Design** appears.

Share Desig	n		×
□ test1 □ test3	owner owner	(23/01/2019 14:20) (23/01/2019 18:09)	
			Cancel

© Select the Design *test1*.

A window named **Change Ownership for test1** appears. Each user can be assigned, by employing a corresponding option from the Actions list, one of the Full, Copy, Test, View $\kappa\alpha$ Delete permissions. Moreover, the window exhibits all the users of the system.

ow 10 🔻 entries		Search:		
User Name \land 🔺	Name 🍦	Permission		Actions
test	George			:
user2	User2			:
user3	User3			
user4	User4		give Full p	ermission
user5	User5		give Copy	permission
user6	User6		give View	permission
XXX	xxx		delete pe	rmission
owing 1 to 7 of 7 entries			Previous	1 Nex

[®] Press **Close** to close the window named **Change Ownership for test1** and press **Cancel** in the window named **Share Design** to return to the main menu of the **Design Mode**.

4.9 Delete a Saved Design or Version

The **Delete** button allows the user to delete a Version of a Design or even the whole Design itself. Click on the **Delete** button and a window named **Delete Design or Version** appears.



In cases where certain Designs are connected with existing simulations, these particular Designs or Versions appear in the window in red letters and the system do not allow the user to delete them.

[®] Press **Cancel** to return to the main menu of the **Design Mode**.

5. Simulation Mode

The **Simulation Mode** is a subsystem of the **Business Simulator** which allows the user to simulate the Designs. To enter the subsystem, click on the button \blacksquare situated in the horizontal tool bar of the system and select the field **Simulation Mode** from the pop-up list.



To perform a simulation is necessary to create a **Simulator** first. The **Simulator** is a simulation environment where the user can perform a simulation, save it, perform other simulations with different parameters and recall previously saved simulations. Each **Simulator** refers to a saved **version** of a **Design**.

The main menu of the **Simulation Mode** includes the following items:

≡∣		Business Simula	tor			 ② √	💄 User1 🗸	^
Simu	lation Mode w							
🗁 Ор	en							ľ
⊘ Vie	w							
🔩 Sha	are							
🕅 Del	lete							
4								*

• New

The **New** button allows the user to start the creation of a new **Simulator**.

• Open

The **Open** button allows the user to open a saved **Simulator**.

• View

The **View** button allows the user to view the **version** of the **Design** that a saved **Simulator** refers to.

• Share

The **Share** button allows the user to assign certain management rights of the **Simulator** to other users.

• Delete

The **Delete** button allows the user to delete a saved **Simulator**.

5.1 Creation of a Simulator

Click on the *New* button in the **Simulation Mode** and a window named **New Simulator** appears.

New Simulator		×
Write the Name fo Design to use.	or the New Simulator and select the Version of the	
Name	sim1	
Designs > Version > C test1 owner: C 1 ver1 (2. C test3 owner)	ons: user1 (23/01/2019 14:20) 3/01/2019 17:58) user1 (22/01/2010 18:00)	
L tests owner:	user1 (23/01/2019 18:09)	
	Car	ncel

In the field **Name**, the user defines the name of the new Simulator.

The window exhibits a list of the available versions of the Designs in which the user can perform simulations.

[®] In the field **Name** set *sim1* and select the **Version** *ver1* of the **Design** *test1*.

Upon completion of this action, the user enters the **Main Screen** of the **Simulator** *sim1*.

≡ INNØV	ET Business Simulator		🂵 😨 ~ 💄 Use	er1 v
Simulation Mode	• Simulator: sim1 (test1, ver1)			
3 Load Run				
🖺 Save Run	1598-pro1	1600.000	2	
	10/100	mach1 0/100	Ĭ	
🖆 Сору	1599-pro2			
🔊 Rename	5/100	•		
🕨 Run				
← Close				
				-
•	-			•

5.2 Main Screen of the Simulator

The **Main Screen** of the **Simulator** is divided in three areas. On the left side of the screen is the **Main Menu** of the **Simulator** *sim1*, in the center there is a tool bar $\bigcirc \bigcirc \bigcirc in in in in in iteration is the version of the Design to which the$ **Simulator**refers.

Moreover, the name of the Simulator and the corresponding Version of the Design appear in a blue

frame. ⁽¹⁾ Simulator: sim1 (test1, ver1)

5.3 Tool Bar

Simulation Time



The first button in the tool bar is **Simulation Time**. Here, the user defines the time period of the simulation.

O Set as:

Time Start 01-01-2020 and hour 08:00:00 **Time End** 03-01-2020 and hour 21:00:00

and press **OK**.

The **Time Step** which it was defined during the creating process of the Design, appears in the window.

Simulation Time			×
Time Start		01-01-2020 08:00:00	
Time End	=	03-01-2020 21:00:00	
Time Step	hour		
		OK Cance	I

Machines Schedule

The second button in the tool bar is the **Machines Schedule**. Press the **Machines Schedule** button. A window appears in which the user can define the operating schedule of each machine during the **Simulation Time**. The user selects the Machine, sets the starting date and time of its operation as well as the ending date and time of its operation and presses the **Add** button to enter the data into the system.

Machines Schedule					×
Add Machines Sche	edule Line				
Machine Fro	m T	°0		Act	ions
mach1 🔻 🚞	01-01-2020 08:00:00	03-01-2020 21:00:00		Add	Load CSV
Machines Schedule	Wed 12:00 Wed 18:00 Thu 00:00 Thu 06:00 Thu	12:00 Thu 18:00 Fri 00:00 Fri 06:00 Search	Fri 12:00 F	Fri 18:00	
Machine ^	From	То	\$	Act	tions
mach1	01-01-2020 10:00:00	02-01-2020 20:00:00		Modify	Delete
mach1	03-01-2020 08:00:00	03-01-2020 19:00:00		Modify	Delete
Showing 1 to 2 of 2 entrie	S Copy Excel CSV PDF Print		Previou	us 1	Next

© Select the Machine mach1, starting and ending time 01-01-2020 and hour 10:00:00 and 02-01-2020 and hour 20:00:00 respectively and press **Add**.

© Select the Machine mach1, starting and ending time 03-01-2020 and hour 08:00:00 and 03-01-2020 and hour 19:00:00 respectively and press **Add**.

A graphical representation of the time period defined by the user, appears in the window. Simultaneously, a corresponding entry is added to the Machines Schedule table at the bottom of the window. The user is able to export the Machine Schedule in **Excel**, **CSV** and **PDF** format files with the use of the respective buttons. The **Load CSV** button allows the user to import the Machine Schedule through a CSV file. Moreover, the user is able to print the Machine Schedule with the **Print** button as well as to copy/paste it with the **Copy** button.

The format of the CSV file the system exports, is presented below.

F	ILE HO	ME INSERT	PAGE LAYOUT	FORMULAS	DATA	REVIEW	VIEW		Sign	in P	
Pas	Le v C	alibri · 11 3 <i>I</i> <u>U</u> · A A ⊡ · <u></u> · A ·		% Number	🔡 Condi 🐨 Forma 🐺 Cell St	tional Form It as Table - tyles -	atting -	Cells	Editing		
Clip	board 🗔	Font	G Alignment	G _k		Styles				^	۶.
A4	.	$\times \checkmark f_x$								~	-
	Α	В	С	D	Е	F	G		Н		h .
1	Machine	From	То								
2	mach1	1/1/2020 10:00	2/1/2020 20:00								
3	mach1	3/1/2020 8:00	3/1/2020 19:00								
4											
5											
6											
7											
8											
9											
10		IRS cim1 machin	os schodule (1)								<u>r</u>
	•		les schedule (1)	(+)	1						
REA	DY						·		— + 1	00%	

The **Modify** & **Delete** buttons cited in the Machine Schedule table at the bottom of the window, allow the user to modify or delete each entry of the schedule. The **Delete All** button allows the user to delete all entries to the schedule.

The system allows to search for entries containing the text that the user enters in the Search field. That text can be any field or part of the entries of the Machines Schedule table.

[®] Press the **Close** button to close the Machines Schedule window.

Purchase Orders

The third button in the tool bar is **Purchase Orders**. Press the **Purchase Orders** button. A window appears in which the user can set the purchase orders of raw materials during the **Simulation Time**. To import an entry in purchase orders, the user selects the Carrier that refers to a particular raw material/product, types the date and time of delivery, the purchased quantity and presses the **Add** button to import the data into the system.

Purchase Orders						,
Add Purchase Orc	der					
Carrier		Quantity		Actions		
1599-pro2	•	11 02-01-2020 23:00:00	13	3	Add	Load CSV
Carrier ^		Delivery Date	Sear Quan	rch:		Actions
1598-pro1		01-01-2020 12:00:00	8 (Kgr)			Delete
1599-pro2		02-01-2020 23:00:00			13 (Kgr)	Delete
showing 1 to 2 of 2 entr	ries Co	ppy Excel CSV PDF Print		Previo	pus 1	Next

© Select the Product pro1, delivery date 01-01-2020 and time 12:00:00, purchased quantity 8 and then press Add.

[®] Select the Product pro2, delivery date 02-01-2020 and time 23:00:00, purchased quantity 13 and then press **Add**.

The user is able to export the Purchase Orders table in **Excel**, **CSV** and **PDF** format files with the use of the respective buttons. The **Load CSV** button allows the user to import the Purchase Orders table through a CSV file. Moreover, the user is able to print the Purchase Orders table with the **Print** button as well as to copy/paste it with the **Copy** button.

The format of the CSV file the system exports, is presented below.

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A1	*	: >	< √ fx	Carrie	r								*
	Α		В	С		D	E		F	G		Н	
1	Carrier	Deli	ivery Date	Quant	ity								
2	1598-pro	1 1/1	/2020 12:00	0 8 (Kgr)									
3	1599-pro	2 2/1	/2020 23:00	0 13 (Kg	r)								
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4	Þ	IBS	sim1 purch	lase ord	ers (2)	(+) :	•				►	
REA	DY					E					+	100%	6

The **Delete** button cited in the Purchase Orders table at the bottom of the window, allows the user to delete each entry of the table. The **Delete All** button allows the user to delete all entries to the table.

The system allows to search for entries containing the text that the user enters in the Search field. That text can be any field or part of the entries of the Purchase Orders table.

[®] Press the **Close** button to close the Purchase Orders window.

Human Schedule

The fourth button in the tool bar is **Human Schedule**. Press the **Human Schedule** button. A window appears in which the user can set the working schedule of human resources during the **Simulation Time**. To create a shift, the user sets the number of employees, the starting time of the shift, the amount of labor hours, the implementation period and presses the **Add** button to import the shift data into the system.

◎ In the field **Persons** type *1*, in the field **Work Start** set the time *08:00:00*, in the field **Hours** select *8*, in the field **From** set *01-01-2020*, in the field **To** set *03-01-2020* and press **Add**.

◎ In the field **Persons** type *1*, in the field **Work Start** set the time *16:00:00*, in the field **Hours** select *8*, in the field **From** set *01-01-2020*, in the field **To** set *03-01-2020* and press **Add**.

Persons	Work Start	Hours Fr	om	То	Act	tions
	08:00:00	8 🔻 🗮	01-01-2020	03-01-2020	Add	Load CS
•	1	Thu 06:00 Thu 12:0	1 I 20 Thu 18:00 Fri 00:00 F	ri 06:00 Fri 12:00 Fri 18:00		
uman Schedule 10w 10 • entries	1 0 Wed 12:00 Wed 18:00 Thu 00:00	Thu 06:00 Thu 12:0	I I 20 Thu 18:00 Fri 00:00 F	in 06:00 Fri 12:00 Fri 18:00 Search:		
uman Schedule 100w 10 🔻 entries Persons ^	1 0 Wed 12:00 Wed 18:00 Thu 00:00	Thu 06:00 Thu 12:0	00 Thu 18:00 Fri 00:00 F	ri 06:00 Fri 12:00 Fri 18:00 Search:	a Ac	tions
uman Schedule now 10 • entries Persons ^ 1	1 0 Wed 12:00 Wed 18:00 Thu 00:00 Work Start 08:00:00	Thu 06:00 Thu 12:0	D0 Thu 18:00 Fri 00:00 F From 01-01-2020	iri 06:00 Fri 12:00 Fri 18:00 Search: 03-01-2020	Ac Modify	tions Delete

A summary chart of labor throughout the period of simulation, is presented in the window. The chart exhibits the number of available employees in green color and the number of employees required by the machines in red color. When the two colors coincide, the green color prevails. For example, from 08:00:00 to 10:00:00 on 01-01-2020 the machines do not require any employees (due to Machine Schedule – red line on 0) but one employee is available according to Human Schedule (idle human – green line on 1). On the contrary, from 00:00:00 to 08:00:00 on 02-01-2020 the machines require one employee (due to Machine Schedule – red line on 1) but no employee is available according to Human Schedule (green line on 0).

If the available employees do not suffice the requirements of the machines, a red mark appears on the left side of the chart. When the available employees suffice the requirements of the machines throughout the simulation period, the preceding mark becomes green. The simulation is feasible only in cases of green marking.

◎ In the field **Persons** type *1*, in the field **Work Start** set the time *00:00:00*, in the field **Hours** select *12*, in the field **From** set *02-01-2020*, in the field **To** set *03-01-2020* and press **Add**.

Human Schedule						×
Add Usersen Calcaded						
Add Human Schedul	e Line					
Persons	Work Start	Hours From	m	То	Actio	ons
	08:00:00	8 🔻 🚞	01-01-2020	03-01-2020	Add L	oad CSV
2 1 • • • • • • • • • • • • • • • • • •	T T T T T T T T T T T T T T T T T T T	1 1 Thu 06:00 Thu 12:00	1 1 1 Thu 18:00 Fri 00:00 Fri 06:0	0 Fri 12:00 Fri 18:00 Search:		
Persons ^	🔺 Work Start 🔶	Hours 🔶	From	То	Acti	ons
1	08:00:00	8	01-01-2020	03-01-2020	Modify	Delete
1	16:00:00	8	01-01-2020	03-01-2020	Modify	Delete
1	00:00:00	12	02-01-2020	03-01-2020	Modify	Delete
Showing 1 to 3 of 3 entries	Copy Excel CSV PDF Prin	nt		Previ	ous 1	Next

The new summary chart of labor throughout the period of simulation, is presented in the window with a green mark. The user is able to export the Human Schedule table in **Excel**, **CSV** and **PDF** format files with the use of the respective buttons. The **Load CSV** button allows the user to import the Human Schedule table through a CSV file. Moreover, the user is able to print the Human Schedule table with the **Print** button as well as to copy/paste it with the **Copy** button.

The format of the CSV file the system exports, is presented below.

F	ILE HO	ME INSE	RT PAGE	LAYOUT	FORMULAS	DATA	REVIEW	VIEW		Sign	in 🔍
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1	Persons	Work Star	Hours	From	То						
2	1	8:00:00	8	1/1/2020	3/1/2020						
3	1	16:00:00	8	1/1/2020	3/1/2020						
4	1	0:00:00	12	2/1/2020	3/1/2020						
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The **Modify** & **Delete** buttons cited in the Human Schedule table at the bottom of the window, allow the user to modify or delete each entry of the schedule. The **Delete All** button allows the user to delete all entries to the schedule.

The system allows to search for entries containing the text that the user enters in the Search field. That text can be any field or part of the entries of the Human Schedule table.

 $\ensuremath{\textcircled{}}$ Press the Close button to close the Human Schedule window.

Sales Orders

The last button in the tool bar is **Sales Orders**. Press the **Sales Orders** button. A window appears in which the user can set the Sales Orders during the **Simulation Time**. To import an entry in sales orders, the user selects the Carrier, the period during which the product sales are feasible, the quantity of goods sold and presses the **Add** button to import the data into the system.

Carrier From Date			o Date	Quantity		Actions	
1600-pro3 🔻	01-01-2020 08:00:00		03-01-2020 11:30:00	7		Add	Load CS\
ales Orders how 10 ▼ en	tries			Searc	h:		
ales Orders how 10 ▼ en Carrier ^	tries From Date	- \$	To Date	Searc	h: Quanti	ty	Actions
ales Orders how 10 v en Carrier ^ 1600-pro3	tries From Date 01-01-2020 08:00:00	\$	To Date 03-01-2020 11:30:00	Searc	h: Quanti	ty 7 (Kgr)	Actions Delete

© Select the *Carrier* that transfers the product *pro3*, starting and ending date where the sale is feasible set *01-01-2020* and hour *08:00:00* and *03-01-2020* and hour *11:30:00* respectively, type quantity of goods sold 7 and press **Add**.

The user is able to export the Sales Orders table in **Excel**, **CSV** and **PDF** format files with the use of the respective buttons. The **Load CSV** button allows the user to import the Sales Orders table through a CSV file. Moreover, the user is able to print the Sales Orders table with the **Print** button as well as to copy/paste it with the **Copy** button.

The format of the CSV file the system exports, is presented below.

F	ILE H	IOME	INSERT	PAGE L	AYOUT	FORMUL	AS DATA	RE	VIEW	VIEW	Sigr	n ►
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A1 \cdot : $\times \checkmark f_x$			Carrie	r							٣	
	Α		В	(2	D	E		F	G		
1	Carrier	Fro	m Date	To Date		Quantity						
2	1600-pro	53 1/1	/2020 8:00	3/1/202	20 11:30	7 (Kgr)						
3												
4												
5												
6												
7												
8												
9												
10												-
IBS sim1 sale orders				orders (1) (Ð	∃				►	
REA	DY								_	+	100%	6

The **Delete** button cited in the Sales Orders table at the bottom of the window, allows the user to delete each entry of the table. The **Delete All** button allows the user to delete all entries to the table.

The system allows to search for entries containing the text that the user enters in the Search field. That text can be any field or part of the entries of the Sales Orders table.

[®] Press the **Close** button to close Sales Orders window.

5.4 Main Menu of the Simulation Mode

The main **Menu** of the Simulation **Mode** environment that appears on the left side of the screen, is presented in the following section:



Load Run: Load a saved run of the Simulator.

Save Run: Save current run of the Simulator.

Copy: Copy the Simulator with a different name.

Rename: Rename the Simulator.

Run: Perform a simulation run.

Create Next: Create a new simulator with the same Design and starting time, the ending time of the current Run.

Close: Exit the Simulator.

Perform a Simulation Run

 $\ensuremath{\textcircled{}}$ O Click on the Run button.

A window named *Simulation Procedure* appears. When the message *Simulation Completed* appears, the simulation is completed.

Simulation Procedure	×
Simulation Completed	
	Ok

[®] Press **OK**.

Save Current Run

[®] Click on the **Save Run** button, type *run1* and press **OK**.

Run Description	×
Write a short Description for the New Run	
run1	
	OK Cancel

Upon this action, a saved copy of the Simulator *sim1* named *run1* is created. This saved Run belongs to the Simulator *sim1* and is referred as a Run of this particular Simulator. The user is able to continue modifying the simulation parameters and performing simulations in the environment of the Simulator without any effects on the state of the saved Run.
At any point, the user can also load any Run of the Simulator that was saved in a preceding time.

Load a Saved Run

[®] Click on the **Load Run** button. A warning window appears, informing the user that upon the loading of the Run, any unsaved changes in the current Simulator will be lost.



[®] Press **OK**.



© Select run1.

Upon this action, the saved Run *run1* of the Simulator *sim1* is loaded in the work environment.

Create a Copy of a Simulator

© Click on the **Copy** button. Type *sim*2.

Upon this action, a copy of the current Simulator named *sim2* is created.

Copy Sim	ulator ×
Name	sim2
	OK Cancel

[®] Press **OK**.



Rename a Simulator

[®] Click on the **Rename** button. Type *sim3*.

Upon this action, the user renames the current Simulator named *sim2* to *sim3*.



[®] Press **OK** and in the menu of the Simulator select **Close**. In the main menu of the Simulation Mode, click on the **Open** button and select *sim1*.

[®] Click on the **Run** button.

Create Next

O Click on the Create Next button.
 O

Create Next	×
The final state of the machines and carriers of the "sim1" Simulator will be saved as a new Version named "ver11" of the Design "test1".	e
A new Simulator named "sim11" will be created and automatically loaded.	
The starting time of the new Simulator "sim11" will be "2020-0 03 21:00:00". The user should redefine the other parameters of the new Simulator.)1- f
OK Cance	el

Upon this action, a window appears informing the user that the final state of the Machines and the Carriers of the Simulator *sim1* will be saved as a new Version named *ver1--1* of the Design *test1*. It also informs the user that a new Simulator named *sim1-1* will be created. The starting time of the

new Simulator *sim1--1* will be the same with the ending time of the current Run. The user should also redefine the other parameters of the new Simulator.

Press OK.

Exit Simulator

O Click on the **Close** button.



Upon this action, a window appears informing the user that in case of an exit from the Simulator, any unsaved Run results in the current Simulator will be lost.

Press OK.

5.5 Open a Saved Simulator

Click on the *Open* button in the menu of the **Simulation Mode** and a window named **Open Simulator** appears.



© Select the Simulator *sim1*.

[®] Press **Close** to return to the main menu of the **Simulation Mode**.



Upon this action, a window appears informing the user that in case of an exit from the Simulator, any unsaved Run results in the current Simulator will be lost.

[®] Press **OK**.

5.6 View a Saved Simulator

The **View** button allows the user to view an existing Simulator. Click on the **View** button and a window named **View Simulator** appears.



[®] Select the Simulator *sim1*.

[®] Press **Close** to return to the main menu of the **Simulation Mode**.

5.7 Share Management Rights of a Saved Simulator

The **Share** button allows the user to share management rights to the Simulators with other users. Click on the **Share** button and a window named **Share Simulator** appears.

Share Simulator	×
 sim1 owner (28/01/2019 20:06) sim11 owner (30/01/2019 11:42) sim3 owner (30/01/2019 11:29) 	Cancel

[®] Select the Simulator *sim1*.

A window named **Change Ownership for sim1** appears. Every user can share one of the following rights: Full, Copy, Order, Run and View or delete permission to deprive these rights by employing the corresponding selection from the Actions list.

Change Ownership for sim1				×
Show 10 V entries		Search:		
User Name \land 🔺	Name 🔶	Permission	\$	Actions
test	George			:
user2	User2			÷
user3	User3			
user4	User4		give Full p	permission
user5	User5		give Copy	
user6	User6		give Run	permission
XXX	XXX		give View	permission
Showing 1 to 7 of 7 entries			delete pe	rmission
0				
				Close

[®] Press **Close** to close the window named **Change Ownership for sim1** and press **Cancel** in the window named **Share Simulator** to return to the main menu of the **Simulation Mode**.

5.8 Delete a Saved Simulator or Run

The **Delete** button allows the user to delete a Run of a Simulator or even the whole Simulator. Click on the **Delete** button and a window named **Delete Simulator or Run** appears.

Delete Simulator or Run	×
 isim1 (28/01/2019 20:06) 1 run1 (30/01/2019 11:28) isim11 (30/01/2019 11:42) cim3 (20/01/2019 11:29) 	
□ sim3 (30/01/2019 11:29)	
	Cancel

◎ Select the Simulator *sim1--1*. The following window appears, warning the user that the preceding Simulator will be deleted.

١	Warni	ng!	×
	⚠	Simulator 'sim11' and all its runs will be deleted! Are you sure you want to continue?	
		OK Cance	el

[®] Press **OK** to delete the Simulator and return to the main menu of the **Simulation Mode**.

6. Results Mode

The **Results Mode** is a subsystem of the **Business Simulator** which allows the user to view and present the results of a Run. The user clicks on the \blacksquare button situated in the horizontal tool bar of the system and selects the field **Results Mode** from the pop-up list, to enter the results screen.

	III 🌒 🗸 🛓 User1 v	•
Simulation Mode	Design Mode	
🗁 Open	Results Mode	
View	Home	
Share		
间 Delete		
		•
innovet.teiemt.gr/bs/logged.php#	•	

Upon this action, the user is transferred to the following screen.



[®] Press **Select** and a window named **Select Run** appears. In this window, select the Run *run1* of the Simulator *sim1*.

Select Run	×
 sim1 (test1, ver1) owner (28/01/2019 20:06) 1 run1 (30/01/2019 11:28) sim3 (test1, ver1) owner (30/01/2019 11:29) 	
	Cancel

The environment of the **Results Mode** appears.

≡ INNĠVET	Business Simulator	🗰 🍞 ~ 🛓 User1 ~
Results Mode	Results for Run: run1 of Simulator: sim1	
View Design		
🗞 Product View	1598-pro1 1600-pro3	
🔀 Carrier View	10/100 mach1 0/100	
Instant View	1599-pro2 5/100	
Incoming Stocks		
Outgoing Stocks		
Excess Production		
Idle Machines		
Ulle Humans		
← Close		
•		•

6.1 Main Menu of the Results Mode

The main **Menu** located on the left side of the screen in the environment of the **Results Mode**, is presented in the following section:



View Design: View the Design to which the simulation results refer.

Product View: View the product quantities throughout the simulation time.

Carrier View: View the quantities of the Carriers throughout the simulation time.

Instant View: View the quantities of the products and the Carriers at a specific time of the simulation.

Incoming Stocks: View the purchases of raw materials/products throughout the simulation time.

Outgoing Stocks: View the sales throughout the simulation time.

Excess Production: View the excess production throughout the simulation time.

Idle Machines: View the idle time of the Machines throughout the simulation time.

Idle Humans: View the idle time of the Humans (employees) throughout the simulation time.

Close: Exit the **Results Mode** environment of the current simulation.

6.2 Product View

O Click on Product View.

A window named *Select Product* appears, which lists all raw materials and products of the Design, in a customized layout. In this window, the user is able to search for any product through the **Search** field.

Select Product				×
Products Show 10 Tentries	Searc	:h:		
Name ^	Lunit		Actio	ns 🍦
pro1	Kgr		Graph	Table
pro2	Kgr		Graph	Table
pro3	Kgr		Graph	Table
Showing 1 to 3 of 3 entries		Previous	1	Next
				Cancel

[®] Click on the **Graph** button of *pro2*.

≡	INNGV	ET Business Simulator	 ? ~	💄 User1 🗸	*
۲	Results Mode View Design	Results for Run: run1 of Simulator: sim1			
&	Product View				
**	Carrier View				
©	Instant View				
÷	Incoming Stocks	2 0 12 PM 06 PM Thược 06 AM 12 PM 06 PM Fritos 06 AM 12 PM 06 PM			
€	Outgoing Stocks	12 PM 06 PM Thu 02 06 AM 12 PM 06 PM Fri 03 06 AM 12 PM 06 PM			
	Excess Production				
	Idle Machines				
₽	Idle Humans				
+	Close				•
				Þ	

In the environment of the system, a graphical representation of the product *pro2* quantities, appears. The vertical axis represents the product quantity and the horizontal axis represents the simulation time. The user is able to select the displayed time span by adjusting accordingly the dynamic frame situated under the graph.

[®] Click on **Product View** and then press the **Table** button of *pro2*.

≡	INNGV	ET Business Simulator			III	AUser1 ~
	Results Mode					
۲	View Design	Results for Run: run1 of Simulator: sim1				
&	Product View	Product: pro2 Show 10 • entries		Sear	ch:	
	Contention	Date & Time 🔿			Amount	
~~~	Carrier View	01-01-2020 08:00:00			5	
		01-01-2020 09:00:00			5	
G	Instant View	01-01-2020 10:00:00			4	
		01-01-2020 11:00:00			4	
_		01-01-2020 12:00:00			3	
ر <del>د</del>	Incoming Stocks	01-01-2020 13:00:00			3	_
		01-01-2020 14:00:00			2	
G	Outgoing Stocks	01-01-2020 15:00:00			2	
		01-01-2020 16:00:00			1	_
	Excess Production	01-01-2020 17:00:00 Showing 1 to 10 of 62 entries Copy Excel CSV PDF Print	Previo	us 1 2 3	1 4 5 6 7 Next	
	Idle Machines					
	Idle Humans					
-	Close					•
•						•

In the environment of the system, a thorough ledger of the product *pro2* quantities appears, in a customized layout.

The user is able to export the preceding ledger of the product *pro2* quantities in **Excel**, **CSV** and **PDF** format files with the use of the respective buttons. Moreover, the user is able to print the ledger with the **Print** button as well as to copy/paste it with the **Copy** button.

The format of the CSV file the system exports, is presented below.

F	ILE HOME	INSERT	PAGE LA	YOUT	FORMU	LAS	DATA RE	VIEW	VIEW	Sigr	ר <b>ו</b>
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1	Α	В	С		D	Е	F	G		Н	۸
1	Date & Time	Amount									
2	1/1/2020 8:00	5									
3	1/1/2020 9:00	5									
4	1/1/2020 10:00	4									
5	1/1/2020 11:00	4									
6	1/1/2020 12:00	3									
7	1/1/2020 13:00	3									
8	1/1/2020 14:00	2									
9	1/1/2020 15:00	2									
10	1/1/2020 16:00	1									•
-	IBS P	roduct pro	2	$\oplus$						•	
REA	DY				III		<u> </u>	-	+	100%	6

## 6.3 Carrier View

#### O Click on Carrier View.

A window named *Select Carrier* appears, which lists all the Carriers of the Design, in a customized layout. In the window, the user is able to search for any Carrier through the **Search** field.

Select Carrier					×
Carriers Show 10 ▼ entr	ies	Search	1:		
Carrier Id 🔷 🔺	Product Name  🍦	Product	Unit 💧	Actions	
1598	pro1	Kgr		Graph	Table
1599	pro2	Kgr		Graph	Table
1600	pro3	Kgr		Graph	Table
Showing 1 to 3 of 3	entries		Previous	1	Next
					Cancel

[®] Click on the **Graph** button of the Carrier *1600*.



In the environment of the system, a graphical representation of the product *pro3* quantities transferred by the Carrier *1600*, appears. The vertical axis represents the product quantity and the horizontal axis represents the simulation time. The user is able to select the displayed time span by adjusting accordingly the dynamic frame situated under the graph.

[®] Click on **Carrier View** and then press the **Table** button of the Carrier *1600*.

	INNG	ET Business Simulator		<b>III</b> (9 ~	🛓 User1 🗸
	Results Mode				
	View Design	Results for Run: run1 of Simulator: sim1			
æ	Product View	Carrier: 1600 - pro3 Show 10 • entries		Search:	-
		Date & Time 🔿 🔺	Amount (Kgr) 🍦	Fullness (%)	
- 24	Carrier View	01-01-2020 08:00:00	0	0.0 %	
		01-01-2020 09:00:00	0	0.0 %	
0	Instant View	01-01-2020 10:00:00	0	0.0 %	
		01-01-2020 11:00:00	1	1.0 %	
•) I	01-01-2020 12:00:00		1	1.0 %	
	Incoming Stocks	01-01-2020 13:00:00	2	2.0 %	
		01-01-2020 14:00:00	2	2.0 %	
G.	Outgoing Stocks	01-01-2020 15:00:00	3	3.0 %	
		01-01-2020 16:00:00	3	3.0 %	
		01-01-2020 17:00:00	4	4.0 %	
	Excess Production	Showing 1 to 10 of 62 entries Copy Excel CSV	PDF Print Previous 1	2 3 4 5 6 7 Next	
	Idle Machines				
	Idle Humans				
+	Close				

In the environment of the system, a thorough ledger of the product *pro3* quantities transferred by the Carrier *1600* and the used capacity of the Carrier, appear in a customized layout.

The user is able to export the preceding ledger of the product *pro3* quantities transferred by the Carrier *1600* in **Excel**, **CSV** and **PDF** format files with the use of the respective buttons. Moreover, the user is able to print the ledger with the **Print** button as well as to copy/paste it with the **Copy** button.

The format of the CSV file the system exports, is presented below.

F	ILE	HOME	INSERT	PAGE L	AYOUT	FORMU	LAS DA	TA REV	'IEW	VIEW	Sign	i 🕨
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Clip	board 🗔					Styles						^
A1	Ŧ	: 🗙	$\checkmark f_x$	Date 8	k Time							*
		A	В	С		D	E	F	G		Н	
1	Date &	Time	Amount									
2	1/1/2	020 8:00	0	5								
3	1/1/2	020 9:00	) !	5								
4	1/1/20	20 10:00	) .	4								
5	1/1/20	20 11:00	) /	4								
6	1/1/20	20 12:00	)	3								
7	1/1/20	20 13:00	) :	3								
8	1/1/20	20 14:00	) :	2								
9	1/1/20	20 15:00	)	2								
10	1/1/20	20 16:00		1	-							-
4	Þ	IBS P	Product pr	·02	(+)		∃				•	
REA	DY					E			-	+	100%	6

## 6.4 Instant View

### © Click on Instant View.

A window named *Select Instant* appears, in which the user is able to view the raw materials/products quantities and the quantities transferred by the Carriers of the Design at a selected point of the simulation time.

Select Instant		×
Run started on: Run ended on: Pick an Instant:	01-01-2020 08:00:00 03-01-2020 21:00:00	
	Show Products Show Carriers	Cancel

[®] Select date 03-01-2020 and time 21:00:00 and press the **Show Products** button.

	ET Business Simulator	III @~	∽ 💄 User1 ∽
Results Mode			
View Design	Results for Run: run1 of Simulator: sim1		
~	Date & Time: 03-01-2020 21:00:00		
noduct View	Show 10 T entries	Search:	_
	Product ^ A Amount	Unit	
Carrier view	pro1	7 Kgr	
	pro2	7 Kgr	
🕒 Instant View	pro3	3 Kgr	
	Showing 1 to 3 of 3 entries Copy Excel CSV PDF Print	Previous 1 Nex	t
➡ Incoming Stocks			
Outgoing Stocks			
Excess Production			
Idle Machines			
Idle Humans			
← Close			Ţ
•			•

In the environment of the system, the quantities of the products appear at the selected point of the simulation time, in a customized layout.

The user is able to export the data in **Excel**, **CSV** and **PDF** format files with the use of the respective buttons. Moreover, the user is able to print the data with the **Print** button as well as to copy/paste them with the **Copy** button.

© Click on **Instant View** and then select the same date and time and press the **Show Carriers** button.

≡ INNØV	ET Business Simulato	r		<b>Ⅲ</b>	Luser1 🗸			
Results Mode	Results for Run: run1 of Simulator: sim1							
🚷 Product View	Date & Time: 03-01-2020 21:00:00           Show 10 • entries           Search:							
<b>•••</b>	Carrier ^	Amount   🍦	Unit 🔶	Fullness (%)				
Carrier View	1598-pro1	7	Kgr	7.0 %				
Instant View	1599-pro2	7	Kgr	7.0 %				
	1600-pro3	3	Kgr	3.0 %				
Incoming Stocks     Outgoing Stocks     Excess Production								
Idle Machines								
Idle Humans								
← Close					Ţ			
4					•			

In the environment of the system, the quantities of the products appear at the selected point of the simulation time, in a customized layout.

The user is able to export the data in **Excel**, **CSV** and **PDF** format files with the use of the respective buttons. Moreover, the user is able to print the data with the **Print** button as well as to copy/paste them with the **Copy** button.

## 6.5 Incoming Stocks

### O Click on Incoming Stocks.

In the environment of the system, a thorough ledger of the purchased inventories during the simulation time, appears in a customized layout.

The user is able to export the preceding ledger of the purchased inventories in **Excel**, **CSV** and **PDF** format files with the use of the respective buttons. Moreover, the user is able to print the ledger with the **Print** button as well as to copy/paste it with the **Copy** button.

≡	INNGV	ET Business Simulator			😨 🗸 💄 User1 🗸
	Results Mode				
۲	View Design	Results for Run: run1 of Simulator: sim1			
æ	Product View	Incoming Stocks: Show 10 • entries		Search:	_
		Date & Time 🔿 🔺	Carrier 🔶	Quantity 🍦	Unit 🔶
- 24	Carrier View	01-01-2020 12:00:00	1598-pro1	8	Kgr
		02-01-2020 23:00:00	1599-pro2	13	Kgr
٩	Instant View	Showing 1 to 2 of 2 entries Copy Excel CSV PDF P	rint	Previ	ous 1 Next
Ð	Incoming Stocks				
G	Outgoing Stocks				
	Excess Production				
	Idle Machines				
	Idle Humans				
+	Close				
•					•

## 6.6 Outgoing Stocks

#### O Click on Outgoing Stocks.

In the environment of the system, a thorough ledger of the realized sales during the simulation time, appears in a customized layout.

≡	INNGV	ET Business	Simulator					Ⅲ ③	🗸 💄 User 1 🗸
	Results Mode								
	View Design	Results for Run: ru	in1 of Simulator:	sim1					
&	Product View	Sales Reliability:	Sales Reliability:						
		Carrier	Last	In Quantities	Descentere	(0)	In Orders		
-1	Carrier View	Carrier 1600 pre2	LOSI	Fuillied	Percentage	(%) LOSC	Fullined	P	100.0 %
~~		1000-0105	0	/	100.	0 70 0	1		100.0 %
	Instant View	Outgoing Stocks:					Search:		_
		Date & Time ^		🔺 Delay (in hour	s) 👙	Carrier 🔶	Qu	antity 🝦	Unit 🔶
-)	Incoming Stocks	03-01-2020 11:00:00		51		1600-pro3		7	Kgr
G	Outgoing Stocks	Showing 1 to 1 of 1 entri	es Copy Excel	CSV PDF Pri	nt			Previous	1 Next
	Excess Production								
	Idle Machines								
₽	Idle Humans								
	Close								

## INNOVET

Moreover, a Sales Reliability table appears, providing evidence of efficiency with respect to sales management e.g. percentage of accomplished sales orders.

The user is able to export the preceding ledger of the realized sales in **Excel**, **CSV** and **PDF** format files with the use of the respective buttons. Moreover, the user is able to print the ledger with the **Print** button as well as to copy/paste it with the **Copy** button.

## **6.7 Excess Production**

#### O Click on Excess Production.

In the environment of the system, a thorough ledger of the lost (defective) product quantities due to overload of the Carriers during the simulation time, appears in a customized layout.

	INNGV	Business Simulator		🗰 🔞 ~ 🛓 User1 ~
	Results Mode			
۲	View Design	Results for Run: run1 of Simulator: sim1		
æ	Product View	Excess Production (products lost when pu Show 10 • entries	shed to full carriers):	Search:
	200 12 102	Date & Time ^ From Machine	🔶 To Carrier 🔶	Lost Quantity 🝦 Unit 🔶
- 24	Carrier View		No data available in table	
©	Instant View	Showing 0 to 0 of 0 entries Copy Excel CSV PDF	Print	Previous Next
÷	Incoming Stocks			
G	Outgoing Stocks			
	Excess Production			
	Idle Machines			
₽	Idle Humans			
+	Close			
•				

The preceding ledger appears vacant without any entries, indicating there are no product losses.

The user is able to export the preceding thorough ledger of the lost product quantities in **Excel**, **CSV** and **PDF** format files with the use of the respective buttons. Moreover, the user is able to print the ledger with the **Print** button as well as to copy/paste it with the **Copy** button.

## 6.8 Idle Machines

#### O Click on Idle Machines.

In the environment of the system, a thorough ledger of the idle time of the Machines due to lack of raw materials/products in the input Carriers during the simulation time, appears in a customized layout. A summary chart of labor throughout the period of simulation, is presented in the window. The chart exhibits the idle time of each Machine in red color and the operating time in blue color. The vacant time periods represent the non operating time of the Machines.

≡	INNGV	ET Business Simulator			1	■ 0	~ 💄 ı	Jser1 🗸		
	Results Mode									
	View Design	Results for Run: run1 of Simulator	: sim1							
æ	Product View	Total Idle Time: 24 hours								
~\$	Wed 12:00 Wed 18:00 Thu 00:00 Thu 06:00 Thu 12:00 Thu 18:00 Fri 00:00 Fri 12:00 Fri 18:00									
Ŀ	Instant View     Idle Machines (not working due to lack of input products):									
		Show 10 🔻 entries			Search:					
•)	Incoming Stocks	Date & Time	From Carrier 🔶	To Machine 🔶	Needed Qua	antity 💧	Unit			
		01-01-2020 19:00:00	1599 - pro2	mach1		1	Kgr			
C,	Outgoing Stocks	01-01-2020 20:00:00	1599 - pro2	mach1		1	Kgr			
6	outpoint stocks	01-01-2020 21:00:00	1599 - pro2	mach1		1	Kgr			
		01-01-2020 22:00:00	1599 - pro2	mach1		1	Kgr			
	Excess Production	01-01-2020 23:00:00	1599 - pro2	mach1		1	Kgr			
		02-01-2020 00:00:00	1599 - pro2	mach1		1	Kgr			
		02-01-2020 01:00:00	1599 - pro2	mach1		1	Kgr			
	Idle Machines	02-01-2020 02:00:00	1599 - pro2	mach1		1	Kgr			
		02-01-2020 03:00:00	1599 - pro2	mach1		1	Kgr			
₽	Idle Humans	02-01-2020 04:00:00	1599 - pro2	mach1		1	Kgr			
		Showing 1 to 10 of 24 entries Copy E	ccel CSV PDF Print		Previous	1 2	3	Next		
	Close									
•								•		

The user is able to export the preceding thorough ledger of the idle time of the Machines in **Excel**, **CSV** and **PDF** format files with the use of the respective buttons. Moreover, the user is able to print the ledger of the idle time of the Machines with the **Print** button as well as to copy/paste it with the **Copy** button.

## 6.9 Idle Humans

### © Click on Idle Humans.

In the environment of the system, a thorough ledger of the idle time of the Humans due to non operating Machines during the simulation time, appears in a customized layout. A summary chart of

the amount and the idle time of labor, is presented in red color. Moreover, the total idle time of labor throughout the period of simulation, appears in the field **Total Idle Humans**. For this particular example, the total idle time of labor is 24 hours.

≡ INNØV	ET Business Simu	lator				🕑 🗸 💄 User1 🗸	<b>^</b>	
Results Mode	Results for Run: run1 of	Simulator: sim1					ľ	
🗞 Product View	Total Idle Humans: 24.0	) hours						
🔀 Carrier View	•	I I I I I Viet 12:00 Wed 18:00 Thu 00:00	Thu 06:00 Thu 12:00 T	1 1 1 hu 18:00 Fri 00:00 Fri 06:00 Fri		-		
L Instant View								
Incoming Stocks	Human Schedule Show 10 Tentries			S	iearch:			
	Persons ^	Work Start	Hours	From	То			
Outgoing Stocks	1	08:00:00	8	01-01-2020	03-01-2020			
	1	16:00:00	8	01-01-2020	03-01-2020			
Excess Production	Showing 1 to 3 of 3 entries	py Excel CSV PDF Print		02-01-2020	Previous	1 Next		
Idle Machines								
<u>Idle Humans</u>								
← Close							-	
•							)	

The user is able to export the preceding thorough ledger of the idle time of the Humans in **Excel**, **CSV** and **PDF** format files with the use of the respective buttons. Moreover, the user is able to print the ledger of the idle time of the Humans with the **Print** button as well as to copy/paste it with the **Copy** button.

## 6.10 View Design

If the user wishes to view the Design of the simulation in the environment of the system, it is feasible by pressing the **View Design** button.

O Click on View Design.

# 7. Case Study: Modeling and Simulation of a Natural Juice Bottling Company

## 7.1 Overview

A major advantage of the modeling and simulation process of a system is the ability to analyze and study various alternatives to a problem and to evaluate their implementation, without requiring the actual (even pilot) implementation of these alternatives. In addition to modeling, another important stage in the simulation process is the validation of the model, where its behavior is controlled against the real situation it imitates and involves comparison with the theoretically expected or actually observed results.

In the case study that follows, the production process of a bottling plant for natural juices is modeled and simulated. The study includes three stages. The first is the stage of creating a model (Design) that models the production line. The second stage involves the creation of the Simulator, which defines the simulation parameters and its running which calculates the Results. The Results are evaluated on the basis of the theoretical expectations. The third stage involves the presentation, analysis and interpretation of the simulation Results.

## 7.2 Create a Model

## 7.2.1 Operation Structure Analysis of the Company

The steps of the company's production line are as follows. The company purchases oranges which are considered as the raw material. Oranges are washed and then squeezed and their natural juice is created. The juice is then bottled in bottles, which are finally packaged with a special film in six-packs.

From the above description of the company operation in processing steps, it appears that for the operation of the company, the following are required: Oranges as the basic raw material, and Bottles and Films as auxiliary raw materials for packaging. The end product of the company is the six-packs of Orange Juice Bottles. During the processing steps, the following intermediate products are also produced: washed Oranges, Orange Juice, and Orange Juice Bottles. The processing steps of the company's production line are shown in detail in the following Production Process Diagram (Flow Chart).

Note: A model may be as detailed or as abstract as the designer wants. If we wanted to describe the operating model of the particular business with more details, we could include the water used in Washing or even the electricity used by the machines at the various processing stages. Considering that both water and electricity are always available in sufficient quantities, we do not include them in this model. Also, we have not included in the model products that are considered not usable and are discarded such as juicing wastes (peelings etc).



Production Process Diagram

## 7.2.2 Products

From the analysis so far, the user is able to record the Products / Raw Materials involved in the various stages of the model and the appropriate Unit of Measurement for each of them as shown in the following table.

Products / Raw Materials	Unit of Measurement
Oranges	Kg (kilogram)
Bottles (empty)	pc (piece)
Film	m (meter)
Washed Oranges	Kg (kilogram)
Orange Juice	L (liter)
Bottled Orange Juice	pc (piece)
6-pack Orange Juice	pc (piece)

## 7.2.3 Carriers

For each product / raw material involved in the model, a procedure of transfer or distribution or simply waiting for a next stage of processing is required. This procedure is described in Design by the term Carrier. Such a procedure can be carried out either from or to a product storage site or in a temporary gathering of products between processing steps.

From the Production Process Diagram the user is able to determine the different types of transfer / distribution / standby processes of the products involved in the model. All of them will be described using Carriers as follows:



Transfer from raw material storage: This Figure describes the transfer from a storage site of basic or auxiliary raw materials as well as the process of distributing them for further processing.



Transfer, temporary gathering and distribution of intermediate products: This Figure describes a temporary intermediate storage site between two processing steps as well as the process of transfer from a previous stage and distribution to a subsequent stage.



Transfer of a final product to a warehouse: This Figure describes the transfer to a final product storage site from a previous processing step.

The characteristics of each Carrier are:

- The product / raw material being transferred.
- The maximum quantity of products that can be served at the point.

The initial condition a Carrier can take is:

• The initial quantity of products that exists at the point.

Note: Carrier transfers as used in this model, is considered to be immediate and without the need for personnel. It essentially describes how the processes are connected to each other, or else the company's internal distribution network for materials.

Then, the Carriers participating in the different stages of this case study model and their features (maximum and initial quantity) are recorded in the table below.

Carrier	<b>Maximum Quantity</b>	<b>Initial Quantity</b>
Oranges	500	500
Bottles	1000	1000
Film	1000	1000
Washed Oranges	100	0
Orange Juice	200	0
Bottled Orange Juice	1000	0
6-pack Orange Juice	200	0

Note: The name of the product / raw material being transferred is used as an indication of each Carrier. The Units of quantities has been defined in the table of products.

## 7.2.4 Machines

The term Machine corresponds to any form of process that receives raw materials from at least one input and produces products at at least one output. Generally, a Machine is able to have multiple inputs or outputs, depending on the number of different raw materials at the input and the different products in the output respectively.

All inputs and outputs of a Machine are connected to Carriers. It is not allowed to connect two Machines without interfering with a Carrier.

From the Production Process Diagram, it is easy to see that in this example we have the following Machines: Washing, Juicing, Bottling and Wrapping. Washing and Juicing have one input and one output, while Bottling and Wrapping have two inputs and one output.

The characteristics of each Machine are:

- Name (e.g. Washing).
- Number of inputs.
- Number of outputs.
- Minimum number of people required for operation.
- The time interval between two consecutive imports of products to be processed (common to all inputs).
- For each input
  - The quantity of Products imported at an input time (different for each input).
- For each output
  - The time interval that processing takes place, from the time the raw material enters the Machine, until the output of the products at each output (different for each output).
  - The quantity of Products produced at each output when the above time interval is completed (different for each output).

The initial state of the Machine is:

• The initial processing state for the production of each product (usually takes a zero value but can be set differently to cover the case a Machine has started working before the start time of the simulation).

Note: In special cases, products may not be modified within a Machine. For example, a long-term storage can be modeled as a Machine, as it has the following features: time interval between consecutive imports, input quantities, output time intervals, output quantities, and required human resources. Also, a material transfer that requires a considerable amount of time and human resources can be modeled as a Machine.

We then assume that the Processes taking place at the various stages of the case study model are implemented with appropriate Machines whose characteristics are presented in the following table.

Process	Inputs	Outputs	Human Resources	Input Time Interval	Input Quantity	Output Time Interval	Output Quantity
Washing	1	1	0.2	1 min			
	Oranges				10		
		Washed Oranges				1 min	10
Juicing	1	1	0.3	5 mins			
	Washed				3		
	Oranges	Orange Juice				3 mins	1
Bottling	2	1	0.3	2 mins			
	Orange Juice				10		
	Bottles				10		
		Bottled Orange Juice				2 mins	10
Wrapping	2	1	0.2	1 min			
	Bottled Orange				60		
	Juice						
	Film				5		
		6-pack				1 min	10
		Orange Juice					

During the first Process (Washing), we assume that a washing machine is used which can wash 10 kg of oranges in 1 minute and is immediately ready to take the next batch.

The second Process is Juicing. Here we assume that the machine at our disposal can process 3 kg of oranges per batch and it takes 3 minutes to produce 1 liter of orange juice. It takes another 2 minutes to discard the wastes of the oranges, so we conclude that it can take the next batch every 5 minutes.

The third Process is Bottling, in which we assume that the machine can bottle every 2 minutes, 10 liters of juice in 10 bottles respectively.

Finally, the fourth Process Wraps within a minute, 10 six-packs of bottles, using 60 bottles and 5 meters of film.

Assuming that all Machines are initially empty, we consider zero the initial state condition of all the above processes.

## 7.2.5. Model Design in Innovet Business Simulator

#### 7.2.5.1. Create a New Design

From the INNOVET Business Simulator home page, select Design Mode. Then we start creating a new Design by clicking the New button on the left menu. In the window that appears, we need to enter values for two parameters: Name and Time Resolution.

The Name parameter refers to the name we will give to the new Design and it is not allowed to be the same as another name we use. We select and type "FreshJuice".

The Time Resolution parameter is particularly important as it is related to the time analysis of the simulation that will be applied to the model that will be created. The possible choices are second, minute, hour, day and week. The right choice is usually determined by the Process parameters and the degree of details that we want the simulation to give. A simulation per second in processes that are evolving on a day level will be very time consuming and the study of the results will be tedious because it will repeat thousands of identical values. Typically, the time intervals of the Process characteristics give a first indication of the Time Resolution to be used. The selection can then be modified but it is directly related to the Process characteristics, so any change in Time Resolution must be accompanied by appropriate adaptation of the characteristics of the Machines.

In this case study, all of the time intervals in the Processes are given in minutes, so, as shown in the following figure, we select as Time the "minute" option. If in a Process the time intervals are set in other time units smaller (e.g. seconds) or higher (e.g. hours) they should be converted to the selected time unit by modifying accordingly the corresponding quantities. By clicking the OK button the new Design is created.

New Design		×
Name	FreshJuice	
Time Resolution	minute	
		OK Cancel

### 7.2.5.2. Inserting Products into Design

Products that should be inserted into Design are those that have been identified as being involved in the production process during the operation analysis of the company and are listed in the Product

Table along with their characteristics. By pressing the button  $\bigotimes$  the Manage Products window is displayed, where we type Name and Unit for each product and click the Add button. At the end, we must have inserted all the products as shown in the following figure:

Manage Products				_	_	×
Add Product						
Name	Unit				A	ctions
						Add
Products Show 10 🔻 entries		Search:				
Name 1		Unit		A	ctio	ns 🍦
6-pack Orange Juice		рс		Mod	lify	Delete
Bottled Orange Juice		рс		Mod	lify	Delete
Bottles		рс		Mod	lify	Delete
Film		m		Mod	lify	Delete
Orange Juice		L		Mod	lify	Delete
Oranges		Kg		Mod	lify	Delete
Washed Oranges		Kg		Mod	lify	Delete
Showing 1 to 7 of 7 entries			Previo	Js [	1	Next

Close

### 7.2.5.3. Inserting Carriers into Design

The Carriers that should be inserted into Design are those that have been identified to be involved in the production process during the operation analysis of the company and are listed in the Carriers Table along with their characteristics. By clicking on the button is the Insert Carrier window is displayed, where we select the Product to carry from a list, the Initial Amount, the Max Amount, and a Line Color that will be used as the color of the Carriers connection lines on the Design drawing.

After completing the process of inserting all Carriers into Design, with the appropriate values for their characteristics and initial conditions, the Design as it should have been drawn is shown in the following figure:

Note: The numbers appearing in front of the name of each Product and characterizing each Carrier may be different.

⑦ Design: FreshJuice	'D 🗱 🗶	
1612-Oranges 500/500	1613-Washed Oranges	
1611-Orange Juice 0/200 1609-Bottles 1000/1000	1608-Bottled Orange Juice 0/1000 1610-Film 1000/1000	1607-6-pack Orange Juice

#### 7.2.5.4. Inserting Machines into Design

Each Process is represented in Design with a Machine. The Machines that should be inserted into Design are those that have been identified as being involved in the production process during the operation analysis of the company and are recorded in the Process Table along with their characteristics. First we will insert the Machines together with their characteristics and then the characteristics of their inputs and outputs as follows:

a) By pressing the button the Insert Machine window is displayed, where we select a Machine Name that characterizes the process that it implements, the Machine Inputs number, the Machine Outputs number, the time interval between two inputs (Next Input Time) and the Required Humans for the operation of the Machine.

After completing the process of inserting all Machines into the Design with the appropriate values for their characteristics, the Design as it should have been drawn is shown in the following figure:



b) Next, the characteristics of the inputs and outputs of each Machine must be determined and the connections between the Machines and the Carriers should be made. The circles on the left side of each Machine are connections for inputs, while those on the right side are output connections.

By right-clicking on an input connection the Update Machine Pad window is shown, where it should be selected from the list of Connectors with which Carrier the specific input will be connected. In this way, it is specified what kind of product the Machine will enter in that input. Also, the input characteristic for Amount to Input is determined. For this case study, the proper values and connections have been recorded in the Process Table.

Similarly, by right-clicking on an input connection the Update Machine Pad window is shown, where it should be selected from the list of Connectors with which Carrier the specific output will be connected. In this way, it is specified what kind of product the Machine will export in that output. Also, the output characteristics for Production Time, Production Amount, and initial state of the Machine is determined. For this case study, the proper values and connections have been recorded in the Process Table (we also consider that the initial state is zero, which means that all machines are initially empty).

After completing the process of defining the input and output connections and their characteristics for all Machines, the Design as it should have been drawn is shown in the following figure:



7.2.5.5. Save Version of a Design

During the creation of the model in Design Mode the changes are stored immediately. When finished, the design must be Saved as a Version so that it can then be used later in a Simulation.

This is done by pressing the Save Version button in the left menu. In the window that appears we need to type a description for this version. We type the text "test1" and press the OK button.

## 7.3. Create and Run a Simulation

## 7.3.1. Description and Objectives

The goal of each simulation is to predict the results of a particular process before the process takes place in real. In this case study, we want first to estimate the maximum output of the final product using the specific amount of raw materials. In these simple cases this calculation can also be made theoretically.

In the following, based on the Process Diagram and the data given for this case study, an initial theoretical analysis of the problem is made:

Considering that we have 500 kg of oranges and that the Washing Machine processes 10 kg at a time, it will need to work 50 times to wash all oranges. Each wash takes one minute, so 50 minutes of operation is needed.

The second machine, the Wrapping Machine, processes 3kg of washed oranges each time and produces 1 liter of juice. So, we can calculate that it will need to work 166 times (the integer part of division 500/3), it will use 498 kg (166  $\times$  3) oranges and it will produce 166 liters of juice. Every time of operation takes 5 minutes, so it will take in total 830 minutes of operation (less than 14 hours).

Observing that we have enough bottles we conclude that all liters of juice can be bottled in 166 bottles. But, the Bottling Machine needs at least 10 liters and 10 bottles per batch, so it will work 16 times (the integer part of 166/10), it will process only the 160 liters of juice and will bottle them in 160 bottles. Each batch operation takes 2 minutes, so it will take up to 32 minutes of operation for bottling.

The 160 bottles could create 26 6-packs and 4 bottles of juice will be left over (observing that we have enough packaging film, we could wrap all 6-packs). But, the Wrapping Machine can process the bottles in batches of 60 pieces. So it will only work twice, pack 120 bottles in total and will create 20 6-packs. Every time of operation takes 1 minute, so it will take only 2 minutes to complete the process.

So, the optimal theoretical result is 20 6-packs of bottles. The process will left over 40 bottles of juice, 6 liters of juice and 2 kg of washed oranges.

This theoretical analysis while correct does not take into account two significant factors: time and space. Problems that can arise in a real situation are:

a) a machine wants to import products into one or more inputs but they do not exist (not yet produced or not purchased) or

b) surplus products are produced by a machine but there is no space to be stored and thus they are destroyed.

For example, in this case study, we see that the space for washed oranges in the Carrier between the Washing and the Juicing Processes as well as the space for juice between the Juicing and the Bottling Processes are relatively small compared to the others and is likely to create a problem. Also, the Juicing Machine is relatively slow compared to the others while the Wrapping Machine is very fast.

Whether these data would cause problems in the operation of the production line can not be easily estimated with a theoretical analysis but can be immediately highlighted when performing a simulation. The simulation also identifies the causes of the problems and can help in finding ways to correct them, by defining an appropriate design of machinery and human resources operation and by executing purchases and sales of products at the right times.

## 7.3.2. Simulation

## 7.3.2.1. Create a New Simulator

From the Innovet Business Simulator home page, select Simulation Mode. Alternatively, if we are in another Mode of Operation, we use the button 🕮 at the top right of the page to go to Simulation Mode. Then we start creating a new Simulator by pressing the New button on the left menu. In the window that appears, we need to enter a value for the Name parameter and choose the Version of the Design that the Simulator will use.

The Name parameter refers to the name we give to the new Simulator and should not be the same as any other name we use in Simulators. We choose to name the Simulator as "FreshJuice_sim". Then we find the Design "FreshJuice" in the list, click to display its Versions and select Version "test1", which is the version we saved in the previous section.

### 7.3.2.2. Defining the Simulator Parameters

Defining the Simulator parameters is done by using the menu 🔊 👁 🖸 🛤 🕟. The parameters that should be defined are:



- Simulation Time: the start and the end time of the simulation,
- Machine Schedule: the time schedule of machines operation.
- Human Schedule: the time schedule of human resources,
- Purchase Orders: the orders for purchasing products (usually raw materials) and
- Sales Orders: the orders for selling products (usually final products).

Defining Simulation Time:

According to the preceding analysis, we need approximately 14 hours of operation for the Juicing Process, and because this process is the most time-consuming, it is indicative of the time that the simulation should last. So let's just choose 16 hours of simulation. To determine the Simulation Time we click on the corresponding button and in the window that appears we choose Time Start: 28-01-2019 06:00:00 and Time End: 28-01-2019 22:00:00. In the same window we see that the selected Time Step is the minute as defined in Design. Overall, the simulation will consist of  $16 \times 60 = 960$  samples (minutes).

Defining Machine Schedule:

a) Washing. The Washing Process takes Oranges as an input and exports Washed Oranges. Because there is not enough space in the output Carrier to manage the entire amount, you should be careful not to overload the Carrier with the Washed Oranges. For this reason we initially put the machine to work for 10 minutes so that based on its characteristics it will wash 100 Kg of Oranges and fill the Washed Oranges Carrier.

This Carrier empties at the pace of the Juicing Machine, which is 3 Kg per 5 minutes, so in 120 minutes (2 hours) it will use 72 Kg of Washed Oranges. So, we caⁿ state that the Washing Machine after the first activation that fills the Carrier will work every 2 hours for 7 minutes in order to refill the Carrier - in a satisfactory pace - with Washed Oranges needed to be imported into the Juicing Machine.

b) Juicing. This Process is the slowest of all, as studied in the previous section. So, we set the machine to operate continuously throughout the simulation.

c) Bottling. This Process may delay its start because it requires at least 10 liters of juice to be produced. This will definitely be done after the 50th minute since Juicing Machine produces 1 liter every 5 minutes. So, we define that the Bottling Machine will operate from the 50th minute until the end of the simulation.

d) Wrapping. This process may delay its start because it requires at least 60 bottles of juice to be produced. This will definitely happen after the 300th minute since the Juicing Machine produces 1 liter every 5 minutes. Because the Wrapping Machine is too fast compared to the others and the Carrier at its input is large enough and it is not in danger of overflowing, we can choose to wait two batches of sixty bottles of juice and to specify that the Wrapping Machine will work from the 600th minute ie the 10th hour of simulation until its end.

We click on the Machine Schedule button and in the window that appears we add the above entries sequentially to create the machines operation schedule as shown in the following figure:

## **INNOVET**

## **Business Simulator Users Manual**

Machines Schedule

#### Add Machines Schedule Line





06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00

Machines Schedule	!			Search:		
Machine ^	From	A.	То	<u></u>	Acti	ons
Bottling	20-01-2019 06:50:00		20-01-2019 22:00:00		Modify	Delete
Juicing	20-01-2019 06:00:00		20-01-2019 22:00:00		Modify	Delete
Washing	20-01-2019 06:00:00		20-01-2019 06:10:00		Modify	Delete
Washing	20-01-2019 08:00:00		20-01-2019 08:07:00		Modify	Delete
Washing	20-01-2019 10:00:00		20-01-2019 10:07:00		Modify	Delete
Washing	20-01-2019 12:00:00		20-01-2019 12:07:00		Modify	Delete
Washing	20-01-2019 14:00:00		20-01-2019 14:07:00		Modify	Delete
Washing	20-01-2019 16:00:00		20-01-2019 16:07:00		Modify	Delete
Washing	20-01-2019 18:00:00		20-01-2019 18:07:00		Modify	Delete
Washing	20-01-2019 20:00:00		20-01-2019 20:07:00		Modify	Delete
Wrapping	20-01-2019 16:00:00		20-01-2019 22:00:00		Modify	Delete
Showing 1 to 11 of 11 entr	ies Copy Excel CSV PDF	Print		Previo	us 1	Next
				De	elete All	Close

#### Defining Human Schedule:

The definition of Human Resource Schedule is very simple for this simulation since all machines require cumulative 1 person staff to operate.

We click on the button that corresponds to the Human Schedule and in the window that appears we see the personnel requirements according to the machine schedule we have set in the previous step and are shown with the red line in the following figure.



We add successively the two records that appear in the next image to meet the personnel requirements for the entire simulation. The green line expresses the working staff and should be higher than the red line so that the simulation can run.

Human Schedule					×	
Add Human Cabadula	line					
Add Human Schedule	Line					
Persons	Work Start	Hours From	π	То	Actions	
	08:00:00	8 🔻 🗰	20-01-2019	20-01-2019	Add Load CSV	
Human Schedule	07:00 08:00 09:00 10:00 11:00	12:00 13:00 14		1 1 1 1 19:00 20:00 21:00 22:00		
Show 10 Tentries				Search:		
Persons ^	Work Start 🔶 Ho	urs 🍦	From	To	Actions	
1	06:00:00 8		20-01-2019	20-01-2019	Modify Delete	
1	14:00:00 8		20-01-2019	20-01-2019	Modify Delete	
Showing 1 to 2 of 2 entries	opy Excel CSV PDF Print			Previo	us 1 Next	
				D	elete All Close	

This simulation does not include Purchase Orders or Sales Orders.

### 7.3.2.3. Run of Simulator

After defining the parameters, the Simulator may run by pressing the Run button in the left menu. The "Please Wait" message appears in the pop-up window as long as the simulation is running. Once the simulation is completed, the message changes to "Simulation Completed".

## 7.3.2.4. Saving the Results

After completing the simulation, its results must be saved. Saving the Results of a Run is done by pressing the Save Run button in the left menu. In the window that appears, a description indicative of the executed Run should be typed. Type "run1" and press the OK button.

## 7.4. Analysis and interpretation of the Results

## 7.4.1 Show and Comment the Results

As has been emphasized at the previous sections, the objective of every simulation is to predict the results of a particular process before the process becomes real. Moreover, the simulation may also indicate shortcomings and redundancies in materials, machine failures, undue delays, redundancy in human resources, and many other details that can not be identified theoretically.

In this case study, we first wanted to estimate what is the maximum possible output of the final product using the specific amount of raw material. The optimal result that was theoretically calculated is 20 6-packs of bottles and a surplus of 40 bottles of juice, 6 liters of juice and 2 kilograms of oranges.

In the following, we will check whether this result has been achieved using the simulation, thus we will evaluate the correctness of the modeling. At the same time, we will identify and comment on problems and ways to improve the production process.

#### 7.4.1.1 Selection of Simulator Run

From the Innovet Business Simulator home page, select Results Mode. Alternatively, if we are in another Mode, we use the button  $\blacksquare$ , located at the top right of the page, to go to Results Mode. Then, we select the results of the Run that we want to see by pressing the Select button on the left menu. From the list that appears, select the Simulator "FreshJuice_sim" and the Run "run1".

#### 7.4.1.2 Instant View

Using the left menu, several simulation results can be displayed in both graphical and tabular formats. The "Instant View" option can show us in tabular form, the amount of Products that are in Carriers for a specific time either per Carrier or cumulatively per Product. If we select the end of the simulation as the specific time, we get the final results.

We click on the 'Instant View' button and in the window that appears we check that the value in 'Pick an Instant' is the time of the end of the simulation, ie '20-01-2019 22:00:00'. Then we press the "Show Products" button and the following result is displayed:
Results for Run: run1 of Simulator: FreshJuice	_sim	
Date & Time: 20-01-2019 22:00:00		
Show 10 • entries	Search:	
Product ^	Amount 🍦	Unit 🔶
6-pack Orange Juice	20	pc
Bottled Orange Juice	40	рс
Bottles	840	pc
Film	990	m
Orange Juice	б	L
Oranges	0	Kg
Washed Oranges	2	Kg
Showing 1 to 7 of 7 entries Copy Excel CSV P	DF Print Previous	1 Next

From the simulation result, it is easy to see that the optimal theoretical result has been achieved. 20 6-packs of orange juice bottles have been produced, while 40 bottles of juice, 6 liters of non-bottled orange juice and 2 kilograms of washed oranges have been remained in the intermediate Carriers.

We also observe that the quantities of auxiliary raw materials have not been significantly consumed since 840 empty bottles have remain (1000-840 = 160 bottles have been used) and 990 meter film remain (1000-990 = 10 meters film have been used). It is thus concluded that the quantities of auxiliary raw materials are too large for the specific quantity of the basic raw material.

#### 7.4.1.3 Product View

It is interesting to see the way of change of Products quantities throughout the simulation time. The following figures show the changes in the quantities of products, especially for the raw material (Oranges), the intermediate products (Washed Oranges, Orange Juice, Bottled Orange Juice) and the final product (6-pack Orange Juice).

### <u>INNOVET</u>

#### Business Simulator Users Manual



Figure (a) shows the change in the amount of Oranges (raw material). From the initial quantity of 500 Kg gradually decreases to zero. The decrease occurs when the Washing Machine operates, ie at the beginning of the simulation for 10 minutes and then every 2 hours for 7 minutes.

Figure (b) shows the change in the amount of Washed Oranges (intermediate product). The amount of this product increases when the washing machine operates and decreases at a slower rate when the Juicing Machine operates.

Figure (c) shows the change in the amount of Orange Juice (intermediate product). The amount of this product increases slowly when the Juicing Machine operates and decreases at a very fast rate when the Bottling Machine operates. This is done when 10 liters of juice is collected in Carrier (this value is not shown in the figure because this quantity is imported directly into the Bottling Machine).

Figure (d) shows the change in the amount of Bottled Orange Juice (intermediate product). The amount of this product gradually increases each time the Bottling Machine operates and decreases when the Wrapping Machine operates. This is done only once when 120 bottles are collected in Carrier (this value is not shown in the figure because this quantity is imported directly into the Wrapping Machine).

Finally, figure (e) shows the critical time of the simulation when the amount of the final product, 6-pack Orange Juice changes. The amount of this product increases when the Wrapping Machine is in operation. The final result is 20 6-packs of orange juice bottles.

More analytical results (exact values for quantities and time) are offered in the selection of presenting results in table format.

#### 7.4.1.4 Idle Machines

Another also very useful result for the future improvement of production line operation is the identification of time intervals when machines are idle, ie while they are programmed to operate, but their operation is not feasible due to lack of required products at their inputs.



In this simulation the result is shown in the following figure:

This figure presents: a) in blue color the time intervals at which the machines were programmed to operate and worked normally; b) in red color the time intervals when the machines were programmed to operate but did not work due to shortcomings of the necessary quantities of products at one or more of their inputs.

From the figure we can see that the Washing Machine has operated smoothly until the amount of the basic raw material (Oranges) has been exhausted.

The Juicing Machine worked almost seamlessly until the raw materials were exhausted. Exclude the red spot at about 18:00 when Washed Oranges appear to be exhausted for a short time.

Although Bottling Machine was scheduled to operate continuously for the time from the 50th minute onwards, most of the time it did not work (red area) due to lack of an input product.

Finally, the Wrapping Machine operates for 2 minutes at the beginning of its programmed operation, completes the wrapping of 120 bottles and then does not operate again (red area) until the end of the simulation, due to lack of the necessary pieces of the input product.

From the above, it is understood that at least the last two machines could have been better scheduled so as not to expect input for such a long time.

#### 7.4.1.5 Issues and Future Extensions

This simulation can be extended in time and enriched with purchases of raw materials or sales of final products. The system can be controlled at its limits and the maximum ability to satisfy sales orders for specific periods of time could be estimated. In addition, better scheduling of machine operation can be made to reduce idle time and also better job scheduling for exploiting company's human resources.

A number of options present the results of simulations in various forms so that conclusions can easily be drawn.

In addition, it is possible to modify the model. From the foregoing analysis and the simulation results, it is easily understood that an additional Juicing Machine would improve the performance of the production process. But at what rate? A new version of Design with two parallel Juicing Machines, possibly with different operating characteristics, is a challenge to study.

# 7.5. Conclusions

In the case study developed in the previous sections, a model of a production process was created and its operation was simulated, based on specific characteristics and initial conditions. The model was evaluated by comparing the results of the simulation with the theoretical expectations.

This makes it easy to see that simulations give the possibility to analyze and study various alternatives to a problem. A simulation can essentially replace the experimental approach and addresses the potential problem of being unable to access a system. It leads to a better understanding of a system, it is a prediction tool but can also be used as a training mechanism.

# 8. Appendices

# 8.1 First Educational Paradigm

The first educational paradigm involves a small water bottling company with one production line. The final product of the production process is 1 liter bottles of water, wrapped in packages of 6 items. The production line is quite simple and it entails the following features:

- The storage container of 3000 liters capacity, of refined water ready for bottling.
- The filling and sealing machine (bottling) of the bottles.
- The wrapping machine in packages of 6 bottles.
- The warehouse for the storage of empty bottles, caps, plastic wrapping film.
- The warehouse of the final products.

Moreover, there is a requirement of refilling the container of refined water as well as to sell specific product quantities during the simulation time.

Carriers Max Capacities	Machines Specifications
Water: 3000 liters	Bottling Machine:
	Inputs: 3
Empty Bottles: 10000 units	30 empty bottles/batch
	30 liters of water/batch
<b>Caps:</b> 30000 units	30 caps
	Outputs: 1
Plastic Wrapping Film: 12000 meters	30 units of bottled water/batch
	Next Input Time: 1 minute
Finished Products: 35000 units of 6-pack Bottled	Process Time 1 minute
Water	Required Human: 1
Bottled Water: 80 bottles.	Wrapping Machine:
	Inputs: 2
	30 units of bottled water/batch
	6 meters plastic wrapping film/batch
	Outputs: 1
	5 units/batch
	Next Input Time: 1 minute
	Processing Time: 2 minutes
	Required Humans: 0

#### **Specifications Table**

The following figure exhibits the structure of the referred production line.



#### Design of the Bottling Water Production Line in the Business Simulator

[®] Select **Design mode** from the starting menu or from the relative icon at the top right corner in the work environment of the Business Simulator.



or



[®] Press the **New** button from the main menu of the Design Mode.

[®] Set **Name** *ex1* and **Time Resolution** *minute* and press **Ok**.

New Design		×
Name Time Resolution	ex1 minute	
	_	
	ОК	Cancel

© Press the solution and create the Machines "*Bottling Machine*" and "*Wrapping Machine*" in accordance with the features embedded in the Specifications Table.

The following window shows the work environment after the creation of the Machines.

≡ INNØ	/ET Business Simulator			 🕲 🗸 💄 User 1 🗸
Design Mode	Design: ex1	D & X &		
🖺 Save Version				
街 Сору		• •	• Wrapping Machine •	
🖉 Rename		Bottling Machine		
▶ Test				
← Close				

⁽¹⁾ Press the solution and and create all the products of the production line (raw materials, semi-finished products and final products) in the Design as they are presented in the following window.

Name	Unit				A	ctions
						Add
Products		Search	:			
Name ^		Unit	÷	А	ctio	ns 🗍
6-pack Bottled Water		units		Mod	lify	Delete
Bottled Water		units		Mod	lify	Delete
Caps		units		Mod	lify	Delete
Emplty Bottles		units		Mod	lify	Delete
Plastic Wrapping Film		meters		Mod	lify	Delete
Water		liters		Mod	lify	Delete
howing 1 to 6 of 6 entries			Previo	15	1	Next

O Press the press

Product to carry	Initial Amount	Max Amount	Line Color
Water	3000	3000	blue
Caps	30000	30000	green
Empty Bottles	10000	10000	red
Bottled Water	0	80	yellow
Plastic Wrapping Film	6000	12000	gray
6-pack Bottled Water	0	35000	orange

The following window shows the work environment after the creation of the Carriers.

#### **INNOVET**

≡	INNGV	ET Business Simulator		 <b>?</b> ~	Luser1 →
12	Design Mode Load Version	O Design: ex1	じ 幕 24 部		
Ð	Save Version	1627 Water	1631-Plastic Wrapping Film		
ආ	Сору	3000/3000 1628-Caps	Interview Wrapping Machine     Wrapping Machine     Wrapping Machine     O/35000		
<b>S</b> AN	Rename	30000/30000 1629-Emplty Bottles	Botting Machine     U/80		
►	Test	10000/10000			
Ļ	Close				

© Click on the right button of the mouse on the input/output pads of the Machines and import their features in accordance with the Specifications Table. The results of the preceding action, appear in the following window.



⁽¹⁾ Press the **button** and then check the behavior of the Design with the assistance of the tool bar. As soon as you finish, press **Close**.



@ Save this Version of the Design named *ex1.v1* 

Version Description	×
Write a short Description for the New Version	
ex1.v1	
OK Cancel	

[®] Then enter into the Simulation Mode.



© Create a new Simulator named *sim.ex1.v1* that refers to the Version *ex1.v1* of the Design *ex1*.

New Simulator		×
Write the Name fo Design to use.	r the New Simulator and select the Version of the	
Name	sim.ex1.v1	
Designs > Versio ~ [] ex1 owner: us [] 1 ex1.v1 ( > [] test1 owner: [] test3 owner:	ns: er1 (03/02/2019 14:27) 04/02/2019 16:13) user1 (23/01/2019 14:20) user1 (23/01/2019 18:09) Ca	ncel

Import the simulation parameters with the use of the tool bar in the environment of the Simulation Mode. First, set Time Start and Time End by pressing the button.

Simulation Time			×
Time Start		24-10-2019 08:00:00	
Time End		24-10-2019 14:00:00	
Time Step	minu	te	
		ОК Сапсе	9

[®] Define the Machine Schedule as it is presented in the following window.

Machines Schedule			×
Add Machines Schedule Li	ine		
Machine	From	То	Actions
Bottling Machine	24-10-2019 08:00:00	24-10-2019 14:00:00	Add Load CSV
Bottling Machine			
Wrapping Machine			
08:00 08	8:30 09:00 09:30 10:00 10:30	11:00 11:30 12:00 12:30 13:00	13:30 14:00
Machines Schedule			
Show 10 <b>v</b> entries		Search:	
Machine ^	From	to to	Actions
Bottling Machine	24-10-2019 08:00:00	24-10-2019 14:00:00	Modify Delete
Wrapping Machine	24-10-2019 08:00:00	24-10-2019 14:00:00	Modify Delete
Showing 1 to 2 of 2 entries Copy	Excel CSV PDF Print	Prev	ious 1 Next
			Delete All Close

[®] Click on the **Human Schedule** button and define the work schedule of employees as it is presented in the following window.

Human Schedule					×
Add Human Schedule	Line				
Persons	Work Start	Hours From	n T	0	Actions
1	08:00:00	6 🔻 🚞	24-10-2019	24-10-2019	Add Load CSV
	I I I 08:30 09:00 09:30	I I 10:00 10:30 11	I I I 00 11:30 12:00 12:30	I I 13:00 13:30 14:00	
Show 10 ▼ entries				Search:	
Persons ^	Work Start 🔶	Hours 🔶	From 🔶	То	Actions
1	08:00:00	6	24-10-2019	24-10-2019	Modify Delete
Showing 1 to 1 of 1 entries	opy Excel CSV PDF Prin	t		Previ	ous 1 Next

[®] Click on the **Purchase Orders** button and define the purchases plan as it is presented in the following window.

Purchase Orders						>
Add Purchase Order Carrier		Delivery Date		Quantity	A	tions
1627-Water	Ŧ	24-10-2019 12:00:00		3000	Add	Load CSV
Show 10 ▼ entries	Delivery D	Date	Qu	Search:		Actions
1627-Water	24-10-201	9 12:00:00		300	0 (liters)	Delete
Showing 1 to 1 of 1 entries Co	ppy Excel	CSV PDF Print		Previ	ous	Next

© Click on the **Sales Orders** button and define the sales plan as it is presented in the following window.

Carrier		From Date	То	Date	Quar	ntity	Ac	tions	
1627-Water	•	24-10-2019 08:00:00		24-10-2019 14:00:00			Add	Load CSV	
how 10 <b>v</b> entries		From Date		To Date	Search:	Quant	tity	Actions	
how 10 v entries		From Date	4	To Date	Search:	Quant	tity	Actions	
how 10 • entries Carrier ^ 1630-Bottled Water		From Date 24-10-2019 11:00:00	0	<b>To Date</b> 24-10-2019 14:00:	Search:	Quant 200	tity (units)	Actions Delete	
how 10  entries Carrier  1630-Bottled Water 1632-6-pack Bottled V	Water	<ul> <li>From Date</li> <li>24-10-2019 11:00:00</li> <li>24-10-2019 08:00:00</li> </ul>	0	To Date           24-10-2019 14:00:           24-10-2019 14:00:	Search:	Quant 200 200	tity (units) (units)	Actions Delete Delete	
how 10  entries Carrier 1630-Bottled Water 1632-6-pack Bottled V 1632-6-pack Bottled V	Water Water	<ul> <li>From Date</li> <li>24-10-2019 11:00:00</li> <li>24-10-2019 08:00:00</li> <li>24-10-2019 13:00:00</li> </ul>	0 0 0	To Date           24-10-2019 14:00:           24-10-2019 14:00:           24-10-2019 14:00:           24-10-2019 14:00:	Search:	Quant 200 200 200	tity (units) (units) (units)	Actions Delete Delete Delete	

[®] Click on the **Run** button in the main menu of the Simulator, to perform the simulation.

Simulation Procedure	×
Simulation Completed	
	Ok

◎ As soon as the simulation is completed, save the current Run of the Simulator named *sim1.run1.ex1.v1* with the assistance of the **Save Run** button.



© Then, enter into the Results Mode and select the Run *sim1.run1.ex1.v1* 



[®] Press the **Product View** button and then press **Graph** or **Table** at the products you wish to review.

Select Product				×
Products Show 10 ▼ entries	Search:			
Name ^	Unit		Actio	ns 🔶
6-pack Bottled Water	units		Graph	Table
Bottled Water	units		Graph	Table
Caps	units		Graph	Table
Emplty Bottles	units		Graph	Table
Plastic Wrapping Film	meters		Graph	Table
Water	liters		Graph	Table
Showing 1 to 6 of 6 entries		Previous	1	Next
				Cancel

The graph of the final product quantities of the production line for this particular simulation, is presented in the following window.



[®] Click on the **Carrier View** button and then press **Graph** or **Table** at the Carriers you wish to review.

Select Carrier					>
Carriers Show 10 ▼ en	tries	Search	:		
Carrier Id 🛛 🔺	Product Name 💧	Produc	t Unit 💧 🔶	Actio	ns 🍦
1627	Water	liters		Graph	Table
1628	Caps	units		Graph	Table
1629	Emplty Bottles	units		Graph	Table
1630	Bottled Water	units		Graph	Table
1631	Plastic Wrapping Film	meters		Graph	Table
1632	6-pack Bottled Water	units		Graph	Table
ihowing 1 to 6 of	6 entries		Previous	1	Next
					Cancel

The graph of the Water raw material quantities in the production line for this particular simulation, is presented in the following window.

= INNO	ET Business Simulator	 	💄 User1 🗸
Results Mode	Results for Run: sim 1.run 1.ex1.v1 of Simulator: sim.ex1.v1		
🗞 Product View			
🔀 Carrier View			
Instant View			
Incoming Stocks	400 08.44 08:30 09.44 09:30 10.44 10:30 11 AM 11:30 12 PM 12:30 01 PM 01:30 02 PM		
Outgoing Stocks	αδο αελω αεία αρώμα αρία το μαι το αρί τιλων τι αρί τρίμαι τιζαρ τρίπου το τρίπου το αρίπου. απο ματά το αρία το αρί		
Excess Production			
Idle Machines			
Idle Humans			
← Close			

© Click on the **Instant View** button, select the specific point of the simulation time at which you wish to view the quantities of the Products or Carriers.



The product quantities in the Carriers for the selected point of time, are presented in the following window.

= INN <b>⊘</b> v	ET Business Simulator			III 🕐 🗸 User1 v
Results Mode				
View Design	Results for Run: sim1.run1.ex1.v1 of Simulator: sim.ex1.v1			
🛞 Product View	Date & Time: 24-10-2019 11:00:00 Show 10 • entries			Search:
net contration	Carrier ^	Amount 🕴	Unit 🔶	Fullness (%)
	1627-Water	0	liters	0.0 %
	1628-Caps	27000	units	90.0 %
🕒 Instant View	1629-Emplty Bottles	7000	units	70.0 %
	1630-Bottled Water	0	units	0.0 %
D Incomine Statio	1631-Plastic Wrapping Film	5400	meters	45.0 %
	1632-6-pack Bottled Water	300	units	0.9 %
Outgoing Stocks	Showing 1 to 6 of 6 entries Copy Excel CSV PDF Print			Previous 1 Next
Excess Production				
Idle Machines				
Idle Humans				
← Close				

[®] Press the **Incoming Stocks** button to display the purchases during the simulation time.

#### **INNOVET**

### **Business Simulator Users Manual**

≡	INNGV	ET Business Simulator				@~ 🛓	User1 🗸
	Results Mode View Design	• Results for Run: sim1.run1.ex1.v1 of Simulator: sim.ex1.v1					
&	Product View	Incoming Stocks: Show 10 • entries		Search:			
24	Carrier View	Date & Time ^         ▲           24-10-2019 12:00:00         ▲	Carrier $rac{1}{2}$	Quantity = 3000	Unit liters		\$
©	Instant View	Showing 1 to 1 of 1 entries Copy Excel CSV PDF Print			Previou	s 1	Next
+ <b>)</b>	Incoming Stocks						
G	Outgoing Stocks						
	Excess Production						
	Idle Machines						
	Idle Humans						
	Close						

[®] Press the **Outgoing Stocks** button to display the sales during the simulation time.

= INN()	VET Business Simulator						III (9 ~ 🛓	User1 🗸
Results Mode	Results for Run: sim1.run1.ex1.v1 of Simu	ilator: sim.ex1.v1						
Product View	Sales Reliability:		in Quantities			in Orders		
	Carrier	Lost	Eulfilled	Percentage (%)	Lost	Fulfilled	Percenta	(%) 976
Carrier View	1632-6-pack Bottled Water	0	400	100.0 %	0	2	1	100.0.%
	1052-b-pack Bottled water	U	400	100.0 %	U	2	1	00.0 %
Instant View	Show 10 V entries					Search	:	
	Date & Time \land	Delay (in minutes)		Carrier		Qu	antity 🍦 Unit	
Incoming Stocks	24-10-2019 08:43:00	43		1632-6-pack Bottled Water			200 units	
	24-10-2019 13:00:00	0		1632-6-pack Bottled Water			200 units	
Outgoing Stocks	Showing 1 to 2 of 2 entries Copy Excel CSV	PDF Print					Previous 1	Next
Excess Production								
Idle Machines								
Idle Humans								
← Close								

[®] Press the **Excess Production** button to display any excess production during the simulation time. During this particular simulation period, no excess production appears.

 $\textcircled{\sc 0}$  Press the Idle Machines button to display the idle time of the Machines during the simulation time.

### **INNOVET**

≡ INNØV	<b>ET</b> Business Simulator				🕽 🗸 💄 User 1 🗸
Results Mode					
View Design	Results for Run: sim1.run1.ex1.v1 of Sim	ulator: sim.ex1.v1			
🗞 Product View	Total Idle Time: 318 minutes				
🔀 Carrier View	Bottling Machine Wrapping Machine 08:00 08:30 09:00	09:30 10:00 10:30 11:00 11:30 12:00	12:30 13:00 13:30 14:00		
Instant View					
→ Incoming Stocks	Idle Machines (not working due to l Show 10 • entries	ack of input products):		Search:	
	Date & Time ^	From Carrier 🔶	To Machine	Needed Quantity	Unit 🔶
Outgoing Stocks	24-10-2019 08:00:00	1630 - Bottled Water	Wrapping Machine	30	units
	24-10-2019 09:40:00	1627 - Water	Bottling Machine	30	liters
	24-10-2019 09:41:00	1627 - Water	Bottling Machine	30	liters
Excess Production	24-10-2019 09:41:00	1630 - Bottled Water	Wrapping Machine	30	units
	24-10-2019 09:42:00	1627 - Water	Bottling Machine	30	liters
Idle Machines	24-10-2019 09:42:00	1630 - Bottled Water	Wrapping Machine	30	units
	24-10-2019 09:43:00	1627 - Water	Bottling Machine	30	liters
_	24-10-2019 09:43:00	1630 - Bottled Water	Wrapping Machine	30	units
Idle Humans	24-10-2019 09:44:00	1627 - Water	Bottling Machine	30	liters
	24-10-2019 09:44:00	1630 - Bottled Water	Wrapping Machine	30	units
← Close	Showing 1 to 10 of 318 entries Copy Excel	CSV PDF Print		Previous 1 2 3 4 5	32 Next

[®] Press the **Idle Humans** button to display the idle time of labor during the simulation time. During this particular simulation period, there is no idle time of labor.

# 8.2 Second Educational Paradigm

This example involves a hydroelectric plant production line. The production line includes the highlevel lake in which the water used for the waterfall is stored. The water of the lake is holded by a dam. By opening the barrier gate, water is passed through a special duct to the power generator. In the final stage the electric energy is led to a 10,000 kwh electric storage facility. The flow of water when the gate is open is equal to 600 m³/h. The generator has a nominal power of 60 kw, which means that it produces 60 kwh of energy in one hour and consumes 300 m³/h of water. If the gate is continuously open, the duct that drives the water from the dam to the generator will overflow due to the greater flow of the gate compared to the one that the generator consumes.



#### Specifications

<b>Carriers Max Capacities</b>	Machines Specifications
<b>Lake:</b> 1000000 m ³	Gate:
	Inputs: 1
Water Tube: 1000 m ³	• 10 m ³ of water
	Outputs: 1
Energy Storage Unit: 10000 kwh	• 10 m ³ of water
	Next Input Time: 1 minute
	Production Time: 1 minute
	Required Human: 1
	•
	Electric Energy Generator:
	Inputs: 1
	• $5 \text{ m}^3 \text{ of water}$
	Outputs: 1
	• 1 kwh of electric energy
	Next Input Time: 1 minute
	Production Time: 1 minute
	Required Humans: 1

The following figure shows the Design of the production line as it should be designed in Design Mode.



[®] Create a new Design named *ex2* and draw inside this the above production line.

[®] Then, save the final version of the Design to Version named *ex2.v1* 

- [®] Go to Simulation Mode and create a new Simulator named *sim.ex2.v1* based on Version *ex2.v1*
- [®] Set the Time Start and Time End of the simulation as in the following figure..

Simulation Time		×
Time Start Time End Time Step	<ul> <li>intersection</li> <li>inter</li></ul>	
	ОК Сапс	el

[®] Set the Machines Schedule as shown below.

Machine	From	To	Acti	ons
Elec. Energy Gen. 🔻	01-10-2018 00:00:00	03-10-2018 00:00:00	Add I	oad CS
Mon 00:00	Mon 06:00 Mon 12:00 Mon 18:00	Tue 00:00 Tue 06:00 Tue 12:00 T	ue 18:00 Wed 00	):00
lachines Schedule				
lachines Schedule	_	Search:		
achines Schedule ow 10 • entries Machine ^	From	Search:	Acti	ons
achines Schedule ow 10   entries Machine ^ Elec. Energy Gen.	From 01-10-2018 01:00:00	Search: Search: 02-10-2018 23:00:00	Acti Modify	ons Delete
achines Schedule ow 10   entries Machine   Elec. Energy Gen. Gate	<ul> <li>From</li> <li>01-10-2018 01:00:00</li> <li>01-10-2018 00:00:00</li> </ul>	Search: <b>To</b> 02-10-2018 23:00:00 01-10-2018 01:00:00	Acti Modify Modify	ons Delete
achines Schedule ow 10  entries Machine  Elec. Energy Gen. Gate Gate	<ul> <li>From</li> <li>01-10-2018 01:00:00</li> <li>01-10-2018 00:00:00</li> <li>01-10-2018 03:00:00</li> <li>01-10-2018 03:00:00</li> </ul>	Search:                 To            02-10-2018 23:00:00           01-10-2018 01:00:00           01-10-2018 04:00:00           01-10-2018 04:00:00	Acti Modify Modify Modify	Delete
achines Schedule ow 10   entries Machine   Elec. Energy Gen. Gate Gate Gate Gate	<ul> <li>From</li> <li>01-10-2018 01:00:00</li> <li>01-10-2018 00:00:00</li> <li>01-10-2018 03:00:00</li> <li>01-10-2018 06:00:00</li> <li>01-10-2018 06:00:00</li> </ul>	Search:	Acti Modify Modify Modify Modify	Delete Delete Delete
achines Schedule ow 10 • entries Machine ^ Elec. Energy Gen. Gate Gate Gate	<ul> <li>From</li> <li>01-10-2018 01:00:00</li> <li>01-10-2018 00:00:00</li> <li>01-10-2018 03:00:00</li> <li>01-10-2018 06:00:00</li> <li>01-10-2018 09:00:00</li> </ul>	Search:           To           02-10-2018 23:00:00           01-10-2018 01:00:00           01-10-2018 04:00:00           01-10-2018 07:00:00           01-10-2018 10:00:00           01-10-2018 10:00:00	Acti Modify Modify Modify Modify Modify	Delete Delete Delete Delete
achines Schedule ow 10 • entries Machine ^ Elec. Energy Gen. Gate Gate Gate Gate	<ul> <li>From</li> <li>01-10-2018 01:00:00</li> <li>01-10-2018 00:00:00</li> <li>01-10-2018 03:00:00</li> <li>01-10-2018 06:00:00</li> <li>01-10-2018 09:00:00</li> <li>01-10-2018 12:00:00</li> </ul>	Search:           To           02-10-2018 23:00:00           01-10-2018 01:00:00           01-10-2018 04:00:00           01-10-2018 07:00:00           01-10-2018 10:00:00           01-10-2018 13:00:00	<ul> <li>Acti</li> <li>Modify</li> <li>Modify</li> <li>Modify</li> <li>Modify</li> <li>Modify</li> <li>Modify</li> <li>Modify</li> </ul>	Delete Delete Delete Delete Delete
achines Schedule ow 10  entries Machine  Elec. Energy Gen. Gate Gate Gate Gate Gate Gate Gate Gate	<ul> <li>From</li> <li>01-10-2018 01:00:00</li> <li>01-10-2018 00:00:00</li> <li>01-10-2018 03:00:00</li> <li>01-10-2018 06:00:00</li> <li>01-10-2018 09:00:00</li> <li>01-10-2018 12:00:00</li> <li>01-10-2018 14:00:00</li> </ul>	To           02-10-2018 23:00:00           01-10-2018 01:00:00           01-10-2018 01:00:00           01-10-2018 07:00:00           01-10-2018 10:00:00           01-10-2018 13:00:00           01-10-2018 13:00:00	Acti Modify Modify Modify Modify Modify Modify Modify	Delete Delete Delete Delete Delete Delete

Persons	Work Start	Hours	From	То	Acti	ons
	08:00:00	8 <b>v</b> i	01-10-2018	03-10-2018	Add I	oad CS
•	1 0 Mon 00:00 Mon 06:00 Mon 12:00	I Mon 18:00	1 1 Tue 00:00 Tue 06:00	Tue 12:00 Tue 18:00 Wed 00	1:00	
luman Schedul how 10 ▼ entrie	0 Mon 00:00 Mon 06:00 Mon 12:00 le 25	I Mon 18:00	Tue 00:00 Tue 06:00	Tue 12:00 Tue 18:00 Wed 00 Search:	::00	
Human Schedul how 10 ▼ entrie Persons ^	Mon 00:00 Mon 06:00 Mon 12:00	Mon 18:00	Tue 00:00 Tue 06:00	Tue 12:00 Tue 18:00 Wed 00 Search:	x.00	ons
Iuman Schedul how 10 ▼ entrie Persons ^ 2	1         0           Mon 00:00         Mon 06:00         Mon 12:00           le         25         Work Start           00:00:00         00:00:00         00:00:00	Mon 18:00	Tue 00:00 Tue 06:00	Tue 12:00 Tue 18:00 Wed 00 Search: O3-10-2018	200	ons Deleta
luman Schedul how 10 ▼ entrie Persons ^ 2 2	1         0           Mon 00:00         Mon 06:00         Mon 12:00           ee         25         Work Start           00:00:00         08:00:00         08:00:00	Hours 8 8	Tue 00:00         Tue 06:00           ♦         From           01-10-2018         01-10-2018	Tue 12:00 Tue 18:00 Wed 00 Search:	Acti Modify Modify	ons Delete

[®] Set the **Human Schedule** as shown in the following figure.

The Purchase Orders for this example correspond to the amount of water entering the lake either from a river or from rainfall. In the example, you may consider that during the simulation time there will be no water inflow into the lake.

© Specify the **Sales Orders** program that corresponds to the electric energy distribution from that stored in the electric energy storage unit to the electricity distribution network as shown in the following figure. The sale order shown on the table corresponds to the electric energy requirement of 600 kwh from the network, at any time available between 02-10-2018 06:00:00 to 03-10-2018 00:00:00.

Sales Orders								×
Add Sales Orders								
Carrier	Fro	m Date	То	Date	Qua	ntity	Ac	tions
1993-water 🔻		01-10-2018 00:00:00		03-10-2018 00:00:00			Add	Load CSV
Show 10 v entries		From Date		To Date	Search:	Quan	tity	Actions
1995-electric energy		02-10-2018 06:00:00		03-10-2018 00:00:00		60	)0 (kwh)	Delete
Showing 1 to 1 of 1 entri	es Co	ppy Excel CSV PD	)F	Print		Previo	bus 1	Next
						D	elete All	Close

[®] Run the simulation by clicking the **Run** button in the Simulator main menu.

Simulation Procedure	×
Simulation Completed	
	Ok

[®] After the simulation is completed, save the simulation results to a Run named *sim1.run1.ex2.v1* by using the **Save Run** button.

[®] Then, go to Results Mode and select the Run named *sim1.run1.ex2.v1* 

[®] Press the **Product View** button and then **Graph** or **Table** on the products you want to review the results.

Select Product				×
Products Show 10 ▼ entries	Search	:		
Name ^	Unit		Action	ns 🔶
electric energy	kwh		Graph	Table
water	cubic meters		Graph	Table
Showing 1 to 2 of 2 entries		Previous	1	Next
				Cancel

The figure below shows the graph of the amount of electric energy at each moment of simulation time.



[®] Click the **Carrier View** button and then **Graph** or **Table** on the Carriers you want to review the results.

Select Carrier					×
Carriera					
Show 10 • entri	ies	Search	n:		
Carrier Id 🔷 🔺	Product Name 🛛 🔶	Product	Unit 🍦	Actio	ns 🔶
1993	water	cubic me	eters	Graph	Table
1994	water	cubic me	eters	Graph	Table
1995	electric energy	kwh		Graph	Table
Showing 1 to 3 of 3	entries		Previous	1	Next
					Cancel

The following figure shows the Graph of the amount of water in the Water Tube at each moment of simulation time.



[®] Press the **Instant View** button and select the specific time of the simulation time in which you want to display the quantities of Products or Carriers.

[®] Press the **Outgoing Stocks** button to show sales, that is, the amount of electric energy that were fed into the electricity distribution network during simulation time.

= INNOV	ET Business Simulator						• ⑦ ~	Luser1 ∽
Results Mode								
View Design	Results for Run: sim1.run1.ex2.v1 o	f Simulator: siı	m.ex2.v1					
🗞 Product View	Sales Reliability:							
			in Quantities			in Orders		
	Carrier	Lost	Fulfilled	Percentage (%)	Lost	Fulfilled	Per	centage (%)
Carrier View	1995-electric energy	0	600	100.0 %	0	1		100.0 %
L Instant View	Outgoing Stocks: Show 10 • entries	Delay (in mi	nutes) 🔶	Carrier	¢	Search:	tity 🍦	Unit 🔶
Incoming Stocks	02-10-2018 06:00:00	0		1995-electric energy			600	kwh
Outgoing Stocks	Showing 1 to 1 of 1 entries Copy Excel	CSV PDF	Print			Pre	evious	1 Next
Excess Production     Idle Machines								
Idle Machines								

[®] Press the **Excess Production** button to display any excess of production during simulation time. During this simulation period, notice that from 01-10-2018 17:19:00 to 02-10-2018 05:59:00 there is an overflow of the Water Tube, which means that Machine Gate works unnecessarily during that time and wastes resources.

#### **INNOVET**

	ET Business Simulator				🎫 🕐 🗸 💄 User1 🗸
Results Mode 🔶					
View Design	Results for Run: sim1.run1.ex2.v1 o	of Simulator: sim.ex2.v1			
🛞 Product View	Excess Production (products los Show 10 • entries	st when pushed to full ca	rriers):	Search:	
and an interview	Date & Time 🔿 🔷	From Machine 🔶	To Carrier 🔶	Lost Quantity 🔶	Unit 🔶
	01-10-2018 17:19:00	Gate	1994 - water	10	cubic meters
	01-10-2018 17:21:00	Gate	1994 - water	10	cubic meters
Instant View	01-10-2018 17:23:00	Gate	1994 - water	10	cubic meters
	01-10-2018 17:25:00	Gate	1994 - water	10	cubic meters
Incoming Stocks	01-10-2018 17:27:00	Gate	1994 - water	10	cubic meters
	01-10-2018 17:29:00	Gate	1994 - water	10	cubic meters
	01-10-2018 17:31:00	Gate	1994 - water	10	cubic meters
Outgoing Stocks	01-10-2018 17:33:00	Gate	1994 - water	10	cubic meters
	01-10-2018 17:35:00	Gate	1994 - water	10	cubic meters
Excess Production	01-10-2018 17:37:00	Gate	1994 - water	10	cubic meters
Udle Machines	Showing 1 to 10 of 102 entries Copy E	xcel CSV PDF Print		Previous 1 2 3 4	5 11 Next

#### [®] Press the **Idle Machines** button to display Machine idle time intervals during simulation time.

Elec. Energy Gen. Gate Mon 00:00 Mon	06:00 Mon 12:00 Mon 18:00 Tue 00:00	Tue 05:00 Tue 12:00 Tue 18:00 Wed 00:00		
le Machines (not working d ow 10 • entries	ue to lack of input products):	To Machine	Needed Quantity	Search:
01-10-2018 02:55:00	1994 - water	Elec. Energy Gen.	5	cubic meters
01-10-2018 02:56:00	1994 - water	Elec. Energy Gen.	5	cubic meters
	1001	The Freeze Con		
1-10-2018 02:57:00	1994 - Water	Elec. Energy Gen.	5	cubic meters
11-10-2018 02:57:00 11-10-2018 02:58:00	1994 - water 1994 - water	Elec. Energy Gen.	5	cubic meters
01-10-2018 02:57:00 01-10-2018 02:58:00 01-10-2018 02:59:00	1994 - water 1994 - water 1994 - water	Elec. Energy Gen. Elec. Energy Gen. Elec. Energy Gen.	5	cubic meters cubic meters cubic meters
11-10-2018 02:57:00 11-10-2018 02:58:00 11-10-2018 02:59:00 11-10-2018 05:00:00	1994 - water 1994 - water 1994 - water 1994 - water	Elec. Energy Gen. Elec. Energy Gen. Elec. Energy Gen. Elec. Energy Gen.	5 5 5 5	cubic meters cubic meters cubic meters cubic meters
1-10-2018 02:57:00 1-10-2018 02:58:00 1-10-2018 02:59:00 1-10-2018 05:00:00 1-10-2018 05:01:00	1994 - water 1994 - water 1994 - water 1994 - water 1994 - water	Elec. Energy Gen. Elec. Energy Gen. Elec. Energy Gen. Elec. Energy Gen. Elec. Energy Gen.	5 5 5 5 5 5 5	cubic meters cubic meters cubic meters cubic meters cubic meters
1-10-2018 02:57:00 1-10-2018 02:58:00 1-10-2018 02:59:00 1-10-2018 05:00:00 1-10-2018 05:01:00 1-10-2018 05:02:00	1994 - water 1994 - water 1994 - water 1994 - water 1994 - water 1994 - water	Elec. Energy Gen. Elec. Energy Gen. Elec. Energy Gen. Elec. Energy Gen. Elec. Energy Gen. Elec. Energy Gen.	5 5 5 5 5 5 5 5	cubic meters cubic meters cubic meters cubic meters cubic meters cubic meters
01-10-2018 02:57:00 01-10-2018 02:58:00 01-10-2018 02:59:00 01-10-2018 05:00:00 01-10-2018 05:01:00 01-10-2018 05:02:00 01-10-2018 05:03:00	1994 - water 1994 - water 1994 - water 1994 - water 1994 - water 1994 - water 1994 - water	Elec. Energy Gen. Elec. Energy Gen. Elec. Energy Gen. Elec. Energy Gen. Elec. Energy Gen. Elec. Energy Gen. Elec. Energy Gen.	5 5 5 5 5 5 5 5 5 5	cubic meters cubic meters cubic meters cubic meters cubic meters cubic meters cubic meters

[®] Press the **Idle Humans** button to display employee inactivity time intervals during simulation time.

#### **INNOVET**

Total Idle Humans: 35.0 hours



## 8.3 Third Educational Paradigm

This example involves the simulation of a small toy production line. In the production line, polypropylene is used as a raw material in the oven for the production of transparent plastic and hard plastic. Then, the transparent plastic and catalyst used as raw materials produce the component A, while the hard plastic and the catalyst used as raw materials produce the component B. Then with the assembly of the component A with the component B the toy is produced. In the final stage the toy is packed in a box by using cardboard. This example is suggested to be simulated with Time Resolution 1 hour.



### Flow Chart

#### **Carriers Max Capacities Machines Specifications** Polypropylene: 100.000 Kg **Oven**: Inputs: 1 Transparent Plastic: 10.000 Kg 1.000 Kg of Polypropylene • Outputs: 2 Hard Plastic: 500 Kg 400 Kg of Transparent Plastic ٠ • 400 Kg of Hard Plastic Next Input Time: 1 hour Catalyst: 5000 liters Production Time: 1 hour Part A: 1.000 units **Required Human: 1** Part B: 15.000 units **Part A production:** Inputs: 2 Ready Toys: 1.000 units • 400 Kg of Transparent Plastic • 100 liters of Catalyst Hard Paper: 10.000 m Outputs: 1 250 units of Part A • Next Input Time: 1 hour Packed Toys: 30.000 units Production Time: 3 hours Required Human: 1 **Part B production:** Inputs: 2 400 Kg of Hard Plastic • • 100 liters of Catalyst Outputs: 1 800 units of Part B • Next Input Time: 1 hour Production Time: 1 hour **Required Human: 0 Assembly Machine:** Inputs: 2 250 units of Part A ٠ 250 units of Part B Outputs: 1 250 units of Ready Toys Next Input Time: 1 hour Production Time: 1 hour **Required Human: 0 Packing Machine:** Inputs: 2 • 100 units of Ready Toys • 30 m of Hard Paper Outputs: 1 1 unit of Packed Toys • Next Input Time: 1 hour Production Time: 1 hour **Required Human: 1**

#### Specifications

The following figure shows the Design of the above mentioned production line as it should be designed in Design Mode.



[®] Create a new Design named *ex3* and draw inside the above production line.

[®] Then, save the final version of Design to Version named *ex3.v1* 

[®] Go to Simulation Mode and create a new Simulator named *sim.ex3.v1* based on Version *ex3.v1* 

[®] Set the Time Start and Time End of the simulation as in the following figure.

Simulation Time			×
Time Start		01-01-2019 00:00:00	
Time End		02-01-2019 00:00:00	
Time Step	hour		
		OK Cance	9

[®] Set the Machines Schedule as shown below.



1st Page

Machine	Fro	om	Т	0		Act	tions
Assembly Machine		01-01-2019 00:00:00		02-01-2019 00:00:00		Add	Load CS
Assembly Machine Oven Packing Machine							
Part A production							
Part B production							
00:00 achines Schedule ow 10 ▼ entries	5	I I I 03:00 06:00 09:00	12:0	0 15:00 18:00 Sea	21:00	00:	00
00:00 achines Schedule ow 10 ▼ entries	•	From	12:0	0 15:00 18:00 Sea	21:00	00: Ac	00 tions
00:00 achines Schedule ow 10 ▼ entries Machine ^ Packing Machine	•	I         I         I           03:00         06:00         09:00           From           01-01-2019 22:00:00	12:0	0 15:00 18:00 Sea To 02-01-2019 00:00:00	21:00	00: Ac	00 tions
00:00 achines Schedule ow 10 ▼ entries Aachine ^ Packing Machine Part A production	•	I         I         I           03:00         06:00         09:00           From         01-01-2019 22:00:00         01-01-2019 03:00:00	12:0	0 15:00 18:00 Sea To 02-01-2019 00:00:00 02-01-2019 00:00:00	rch:	00: Ac Modify Modify	00 tions Delet
00:00 achines Schedule ow 10 ▼ entries Machine ^ Packing Machine Part A production Part B production		I         I         I           03:00         06:00         09:00           From         01-01-2019 22:00:00         01-01-2019 03:00:00           01-01-2019 03:00:00         01-01-2019 03:00:00         01-01-2019 03:00:00	12:0	0 15:00 18:00 Sea To 02-01-2019 00:00:00 02-01-2019 00:00:00 01-01-2019 04:00:00	21:00	00: 00: Modify Modify Modify	tions Delete Delete
00:00 achines Schedule pw 10 ▼ entries Machine ^ Packing Machine Part A production Part B production Part B production		From         I           01-01-2019 03:00:00         09:00           01-01-2019 03:00:00         01-01-2019 03:00:00           01-01-2019 03:00:00         01-01-2019 03:00:00	12:0	0 15:00 18:00 Sea To 02-01-2019 00:00:00 02-01-2019 00:00:00 01-01-2019 04:00:00 01-01-2019 07:00:00	rch:	00: Modify Modify Modify	tions Deleta Deleta Deleta
00:00 achines Schedule ow 10 ▼ entries Machine ^ Packing Machine Part A production Part B production Part B production Part B production		I         I         I           03:00         06:00         09:00           From         01-01-2019 22:00:00         01-01           01-01-2019 03:00:00         01-01         01-01           01-01-2019 03:00:00         01-01         01-01           01-01-2019 03:00:00         01-01         01-01           01-01-2019 03:00:00         01-01         01-01	12:0	0 15:00 18:00 Sea To 02-01-2019 00:00:00 02-01-2019 00:00:00 01-01-2019 04:00:00 01-01-2019 07:00:00 01-01-2019 10:00:00	rch:	00: Modify Modify Modify Modify	tions Deleta Deleta Deleta Deleta
00:00 achines Schedule pw 10 ▼ entries Machine ^ Packing Machine Part A production Part B production Part B production Part B production Part B production		I         I           03:00         06:00         09:00           From         01-01-2019 22:00:00         01-01           01-01-2019 03:00:00         01-01         01-01           01-01-2019 03:00:00         01-01         01-01           01-01-2019 06:00:00         01-01         01-01           01-01-2019 09:00:00         01-01         01-01           01-01-2019 09:00:00         01-01         01-01	12:0	0 15:00 18:00 Sea To 02-01-2019 00:00:00 02-01-2019 00:00:00 01-01-2019 07:00:00 01-01-2019 10:00:00 01-01-2019 13:00:00	rch:	Ac Modify Modify Modify Modify Modify	tions Delete Delete Delete Delete Delete
00:00 achines Schedule ow 10 ▼ entries Machine ^ Packing Machine Part A production Part B production Part B production Part B production Part B production Part B production Part B production		I         I           03:00         06:00         09:00           From	12:0	0 15:00 18:00 Sea To 02-01-2019 00:00:00 01-01-2019 00:00:00 01-01-2019 07:00:00 01-01-2019 10:00:00 01-01-2019 13:00:00 01-01-2019 16:00:00	rch:	00: Modify Modify Modify Modify Modify Modify	tions Delete Delete Delete Delete Delete Delete
00:00 achines Schedule ow 10 ▼ entries Machine ^ Packing Machine Part A production Part B production		I         I           03:00         06:00         09:00           From         01-01-2019 22:00:00         01-01           01-01-2019 03:00:00         01-01         01-01           01-01-2019 03:00:00         01-01         01-01           01-01-2019 03:00:00         01-01         01-01           01-01-2019 03:00:00         01-01         01-01           01-01-2019 12:00:00         01-01         01-01           01-01-2019 15:00:00         01-01         01-01           01-01-2019 18:00:00         01-01         01-01		0 15:00 18:00 Sea To 02-01-2019 00:00:00 02-01-2019 00:00:00 01-01-2019 04:00:00 01-01-2019 07:00:00 01-01-2019 10:00:00 01-01-2019 13:00:00 01-01-2019 19:00:00	rch:	00: Modify Modify Modify Modify Modify Modify Modify	tions Deleta Deleta Deleta Deleta Deleta Deleta Deleta

# 2nd Page

Persons		Wo	o <mark>rk St</mark> art		Hours	From		т	0		Act	ions
		<b></b>	08:00:00		8 🔻	<b>1</b> 01	-01-2019		02-01-2019		Add	Load CS
10	1											
Human Schedule ihow 10 ▼ entries	1 00:00	N	03:00	06:00	<b>I</b> 09:00	12:00	) 15:00	18:00	1 21:00 Sea	00:00		
Human Schedule how 10 v entries Persons ^	2 1 00:00 e s	Worl	03:00	I 06:00	U 09:00 Hours	12:00	1 0 15:00 From	18:00	I 21:00 Sea	00:00	Ac	tions
Human Schedule how 10 ▼ entries Persons ^ 3	2 1 00:00 e s	Worl	03:00 ( Start ):00	06:00	09:00	12:00	и о 15:00 From 01-01-2019	I 18:00	21:00 Sea To 02-01-2019	00:00	Ac Modify	tions
luman Schedule how 10 ▼ entries Persons ^ 3 3	2 1 00:00 e s	Worl 00:00 08:00	03:00 c Start ):00 ):00	I 06:00	09:00 Hours 8 8	12:00	From 01-01-2019 01-01-2019	T 18:00	21:00 Sea 70 02-01-2019 02-01-2019	00:00 arch:	Ac Modify Modify	tions Delete

[®] Set the Human Schedule as shown in the following figure.

© Set the Sales Order as shown in the following figure.

Sales Orders										
Add Sales Orders										
C	arrier	From Date		To Date		Quantity		Actions		
1	996-Polypropylene 🔻	5-Polypropylene 🔻 🚞 01-01-2019 00:00:00			02-01-2019 00:00:00	01-2019 00:00:00		Add	Load CSV	
She	ow 10 ▼ entries	From Date		\$	S To Date	earch:	Quanti	ty	Actions	
2	2004-Packed Toys 01-01-2019 00:00:00		00:00:00	01-01-2019 23:00:00			10	(units)	Delete	
Showing 1 to 1 of 1 entries Copy Excel CSV PDF Print						Previo	ls [1	Next		
							De	lete All	Close	

[®] Run the simulation by clicking the **Run** button in the Simulator main menu.

Simulation Procedure	×
Simulation Completed	
	Ok

◎ After completing the simulation, save the results to a Run named *sim1.run1.ex3.v1* using the **Save Run** button.

[®] Then go to Results Mode and select the Run named *sim1.run1.ex3.v1* 

[®] Press the **Product View** button and then **Graph** or **Table** on the products you want to review the results.
Select Product				×
Products Show 10 • entries	Search	:		
Name ^	Unit	\$	Actio	ns 🍦
Catalyst	liters		Graph	Table
Hard Paper	meters		Graph	Table
Hard Plastic	Kg		Graph	Table
Packed Toys	units		Graph	Table
Part A	units		Graph	Table
Part B	units		Graph	Table
Polypropylene	Kg		Graph	Table
Ready Toys	units		Graph	Table
Transparent Plastic	Kg		Graph	Table
Showing 1 to 9 of 9 entries		Previous	1	Next
				Cancel

The following figure shows the graph of the finished toys at each moment of the simulation time.



[®] Press the Carrier View button and then Graph or Table on the Carriers you want to review the results.

arriers	ries	Coarch			
Carrier Id 🔺	Product Name	Product	·   t Unit 💧	Action	ns 🌢
1996	Polypropylene	Kg		Graph	Table
1997	Transparent Plastic	Kg		Graph	Table
1998	Hard Plastic	Kg		Graph	Table
1999	Catalyst	liters		Graph	Table
2000	Part A	units		Graph	Table
2001	Part B	units		Graph	Table
2002	Ready Toys	units		Graph	Table
2003	Hard Paper	meters		Graph	Table
2004	Packed Toys	units		Graph	Table
nowing 1 to 9 of 9	entries		Previous	1	Next
					Cancel

The graph below shows the graph of the amount of available catalyst at Carrier 1999 at each moment of simulation time.



[®] Press the **Instant View** button and select the specific time of the simulation time in which you want to display the quantities of Products or Carriers.

[®] Press the <b>Outgoing Stocks</b> button to show sales that were made or lost during simulation ti	me.
----------------------------------------------------------------------------------------------------------------	-----

• Results for Run: sim1.run1.ex3.v1 o	of Simulator: sim.ex3.v1							
Sales Reliability:								
		in Quantities				in Orders		
Carrier	Lost	Fulfilled	Perc	entage (%)	Lost	Fulfilled		Percentage (%)
2004-Packed Toys	10	0		0.0 %	1	0		0.0 %
Outgoing Stocks: Show 10 V entries							Search:	
Date & Time 🔿		Delay (in hours)	\$	Carrier		\$	Quantity 🍦	Unit 🔶
- Lost on 02-01-2019 00:00:00				2004-Packed	l Toys		10	units
Showing 1 to 1 of 1 entries Copy Excel	CSV PDF Print					· · · ·	Previou	s 1 Next

[®] Press the **Excess Production** button to display any excess production at simulation time. During this simulation period, you notice that at the moments of 01-01-2019 03:00:00, 01-01-2019 05:00:00 and 01-01-2019 06:00:00 there are overflows of the Carrier 1998 that stores Hard Plastic, which means that the Machine Oven runs unnecessarily on this specific time interval and wastes resources.

Results for Run: sim1.run1.ex3.v1 of Simulator: sim.ex3	8.v1			
Excess Production (products lost when pushed	to full carriers):			
Show 10 T entries			Search:	
Date & Time 🔿 🔺	From Machine 🔶	To Carrier 🔶	Lost Quantity 🍦	Unit 🔶
01-01-2019 03:00:00	Oven	1998 - Hard Plastic	400	Kg
01-01-2019 05:00:00	Oven	1998 - Hard Plastic	400	Kg
01-01-2019 06:00:00	Oven	1998 - Hard Plastic	400	Kg
Showing 1 to 3 of 3 entries Copy Excel CSV PDF Pr	int		Previ	ious 1 Next

[®] Press the **Idle Machines** button to display Machine idle times during simulation time.

### INNOVET

	m.ex3.v1			
Total Idle Time: 57 hours				
Assembly Machine				
Oven				
Packing Machine				
Part A production				
Part B production				
Tue 00:00 Tue 03:00 Tue 06:00	Tue 09:00 Tue 12:00 Tue 15:00 Tue 18:00 Tue 2	1:00 Wed 00:00		
Idle Machines (not working due to lack of i	nput products):			
Idle Machines (not working due to lack of i Show 10 • entries	nput products):		Search:	
Idle Machines (not working due to lack of i Show 10 V entries Date & Time ^	nput products):	To Machine	Search: Needed Quantity	Unit 🔶
Idle Machines (not working due to lack of i show 10 v entries Date & Time ^ A 01-01-2019 04:00:00	rput products): From Carrier 1999 - Catalyst	To Machine Part A production	Search: Needed Quantity 100	Unit 🔶 liters
Idle Machines (not working due to lack of i show 10 v entries Date & Time ^ A 01-01-2019 04:00:00 01-01-2019 05:00:00	From Carrier 🔶 1999 - Catalyst 1996 - Polypropylene	To Machine Part A production Oven	Search: Needed Quantity 100 1000	Unit 🔶 liters Kg
Idle Machines (not working due to lack of i           show 10 retries           Date & Time ^           01-01-2019 04:00:00           01-01-2019 05:00:00           01-01-2019 05:00:00	rput products): From Carrier  1999 - Catalyst 1996 - Polypropylene 1999 - Catalyst	To Machine Part A production Oven Part A production	Search: Needed Quantity 100 1000 100	Unit 🔶 liters Kg liters
Idle Machines (not working due to lack of i           show 10 retries           Date & Time ^           01-01-2019 04:00:00           01-01-2019 05:00:00           01-01-2019 05:00:00           01-01-2019 05:00:00	From Carrier    From Carrier   1999 - Catalyst  1999 - Catalyst  1999 - Catalyst	To Machine Part A production Oven Part A production Part B production	Search: Needed Quantity 100 1000 100 100	Unit 🔶 liters Kg liters liters
Idle Machines (not working due to lack of i           show 10 • entries           Date & Time ^           01-01-2019 05:00:00           01-01-2019 05:00:00           01-01-2019 05:00:00           01-01-2019 05:00:00           01-01-2019 05:00:00	From Carrier    From Carlier  1999 - Catalyst  1996 - Polypropylene  1999 - Catalyst  1996 - Polypropylene	To Machine Part A production Oven Part A production Part B production Oven	Search: Needed Quantity 100 1000 1000 1000 1000 1000	Unit Ilters Kg Ilters Ilters Kg
Ide Machines (not working due to lack of i           show 10 • entries           Date & Time ^           01-01-2019 05:00:00           01-01-2019 05:00:00           01-01-2019 05:00:00           01-01-2019 05:00:00           01-01-2019 05:00:00           01-01-2019 05:00:00           01-01-2019 05:00:00           01-01-2019 05:00:00	From Carrier    From Carrier   From Carrier    From Carrier    From Carrier    From Carrier    From Carrier    From Carrier    From Carrier    From Carrier    From Carrier    From Carrier    From Carrier    From Carrier    From Carrier    From Carrier    From Carrier    From Carrier    From Carrier    From Carrier    From Carrier    From Carrier    From Carrier    From Carrier    From Carrier    From Carrier    From Carrier    From Carrier    From Carrier     From Carrier     From Carrier     From Carrier     From Carrier     From Carrier     From Carrier     From Carrier     From Carrier     From Carrier     From Carrier     From Carrier      From Carrier      From Carrier	To Machine Part A production Oven Part A production Part B production Oven Packing Machine	Search: Needed Quantity 100 1000 1000 1000 1000 1000 1000	Unit Ilters Kg Ilters Ilters Kg units
Idle Machines (not working due to lack of i           show 10 • entries           Date & Time ^           01-01-2019 04:00:00           01-01-2019 05:00:00           01-01-2019 05:00:00           01-01-2019 05:00:00           01-01-2019 05:00:00           01-01-2019 05:00:00           01-01-2019 05:00:00           01-01-2019 05:00:00           01-01-2019 05:00:00           01-01-2019 06:00:00	From Carrier   From Carrier  1999 - Catalyst  1996 - Polypropylene  1999 - Catalyst  1999 - Catalyst  2002 - Ready Toys  1999 - Catalyst	To Machine Part A production Oven Part A production Oven Part B production Oven Packing Machine Part A production	Search: Needed Quantity 100 1000 1000 1000 1000 1000 1000 1000	Unit Ilters Kg Ilters Ilters Kg Units Ilters Ilters
Idle Machines (not working due to lack of i           show 10 • entries           Date & Time ^           01-01-2019 04:00:00           01-01-2019 05:00:00           01-01-2019 05:00:00           01-01-2019 05:00:00           01-01-2019 05:00:00           01-01-2019 05:00:00           01-01-2019 05:00:00           01-01-2019 05:00:00           01-01-2019 05:00:00           01-01-2019 05:00:00           01-01-2019 05:00:00           01-01-2019 05:00:00	From Carrier   From Carrier  From Carrier  Second S	To Machine Part A production Oven Part A production Part A production Oven Part B production Oven Packing Machine Part A production Oven	Search: Needed Quantity    Needed Quantity	Unit liters Kg liters liters Kg units liters Kg Kg
Ide Machines (not working due to lack of i           show 10 • entries           Date & Time ^           01-01-2019 04:00:00           01-01-2019 05:00:00           01-01-2019 05:00:00           01-01-2019 05:00:00           01-01-2019 06:00:00           01-01-2019 06:00:00           01-01-2019 06:00:00           01-01-2019 06:00:00           01-01-2019 06:00:00           01-01-2019 06:00:00           01-01-2019 07:00:00	From Carrier   From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  From Carrier  F	To Machine  Part A production Oven Part A production Part B production Oven Packing Machine Part A production Oven Packing Machine	Search: Needed Quantity 0 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000	Unit liters Kg liters liters Kg units Kg units
Ide Machines (not working due to lack of i           Show 10 • entries           Date & Time ^         Image: Comparison of the stress of the	From Carrier   From Carrier  1999 - Catalyst  1996 - Polypropylene  2002 - Ready Toys  1999 - Catalyst  1999 - Catalyst  1999 - Catalyst	To Machine Part A production Oven Part A production Part B production Oven Packing Machine Part A production Oven Oven Packing Machine Part A production	Search: Needed Quantity   Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantity  Needed Quantit	Unit liters Kg liters Kg units liters Kg units liters liters liters

#### [®] Press the **Idle Humans** button to display employee inactivity times during simulation time.

• Results for Run: sim1.run1.ex3.v1 of Sim	ulator: sim.ex3.v1						
Total Idle Humans: 13.0 hours							
4 Tue 00.00 Human Schedule Show 10 T entries	I I I I Tue 06:00 Tue 09:00 Tue 12:00 Tue 1	5.00 Tue 18:00 Tue 21:00	 Wed 00.00	Search	12		
Persons ^	Work Start	Hours	From	То			
3	00:00:00	8	01-01-2019	02-01-2019			
3	08:00:00	8	01-01-2019	02-01-2019			
3	16:00:00	8	01-01-2019	02-01-2019			
Showing 1 to 3 of 3 entries Copy Excel CS	V PDF Print				Previous	1	Next

Notice that the order for 10 Packed Toys was not fulfilled because no such products were
 produced. There were also periods of inactivity of employees and unnecessary machine operation.
 Correct the appropriate schedules in Simulation Mode to eliminate the above problems in the
 production line.

### 8.4 Fourth Educational Paradigm

This example concerns a production line of bottling juice and packing them in packs of 12 bottles. At first, the propylene which is the raw material for the manufacture of the bottles and packaging material is fed into the ovens, to create bottles, caps and packaging material. The empty bottles are transferred to the juice filling machine and then to the bottling machine. The caps are advanced to the bottling machine. After the seal has been completed, the finished bottles are pushed into the packing machine where they are packaged in packs of 12. For this example, a 39-hour simulation is proposed.



**Flow Chart** 

#### **Table of Specifications**

<b>Carriers Max Capacities</b>	Machines Specifications
Polypropylene: 10.000 Kg	Bottle Moulding Machine:
Empty Bottles: 30.000 units	Inputs: 1 • 100 Kg of Polypropylene Outputs: 1 • 9.500 units of Empty Bottles Next Input Time: 1 hour
<b>Caps:</b> 100.000 units	Production Time: 1 hour Required Human: 1
Packaging Film: 20.000 m	Cap Moulding Machine:
<b>Juice:</b> 100.000 liters	Inputs: 1 • 100 Kg of Polypropylene
Filled Bottles: 6.000 units	• 21.250 units of Caps Next Input Time: 1 hour
Sealed Bottles: 7.000 units	Production Time: 1 hours Required Human: 1
Packs of Bottles: 1.000.000 units	Packaging Film Production: Inputs: 1 100 Kg of Polypropylene Outputs: 1 4.900 m of Packaging Film Next Input Time: 1 hour Production Time: 1 hour Required Human: 1 Juice Filling Machine: Inputs: 2 5.000 liters of Juice 5.000 units of Empty Bottles Outputs: 1 5.000 units of Filled Bottles Next Input Time: 2 hour Production Time: 2 hour Required Human: 0 Bottle Sealing Machine: Inputs: 2 5.000 units of Filled Bottles 5.000 units of Caps Outputs: 1 5.000 units of Caps Outputs: 1 5.000 units of Sealed Bottles Next Input Time: 1 hour Production Time: 1 hour Required Human: 1 Packaging Machine: Inputs: 2 3.000 units of Sealed Bottles 250 m of Packaging Film Outputs: 1 250 units of Packs of Bottles Next Input Time: 1 hour Production Time: 1 hour

The following figure shows the Design of the above production line as it should be designed in Design Mode.



- © Create a new Design named *ex4* and draw inside the above production line.
- [®] Then save the final version of Design to Version named *ex4.v1*
- [®] Go to Simulation Mode and create a new Simulator named *sim.ex4.v1* based on Version *ex4.v1*

[®] Set the Time Start and Time End of the simulation as in the following figure.

Simulation Time		×
Time Start		01-01-2019 00:00:00
Time End	hour	02-01-2019 00:00:00
Time step		
		OK Cancel

[®] Set the **Machine Schedule** as shown below.

1st Page



2nd Page



Human Schedule Add Human Schedule Line Persons Work Start Hours From То Actions 01-10-2018 03-10-2018 08:00:00 8 ۳ Add Load CSV 7 Mon 06:00 Mon 12:00 Mon 18:00 Tue 00:00 Tue 06:00 Tue 12:00 Tue 18:00 Wed 00:00 Wed 06:00 Mon 00:00 Human Schedule Show 10 🔻 entries Search: Persons ^ . Work Start Hours From То Actions 08:00:00 01-10-2018 03-10-2018 2 8 Modify Delete 2 13:00:00 01-10-2018 03-10-2018 4 Modify Delete 2 17:00:00 8 01-10-2018 03-10-2018 Modify Delete 5 00:00:00 8 01-10-2018 03-10-2018 Modify Delete Showing 1 to 4 of 4 entries Copy Excel CSV PDF Print Previous 1 Next Close Delete All

#### [®] Set the **Human Schedule** as shown in the following figure.

[®] Set the **Sales Orders** as shown in the following figure.

Carrier	Fro	m Date	То	Date	Quar	ntity	Ad	tions
2005-Polypropyler 🔻	=	01-10-2018 00:00:00		03-10-2018 06:00:00			Add	Load CS
how 10 <b>v</b> entries					Search:			
how 10 • entries		From Date	4	To Date	Search:	Quant	tity	Actions

[®] Run the simulation by clicking the **Run** button in the Simulator main menu.

Simulation Procedure	×
Simulation Completed	
	Ok

◎ After completing the simulation, save the simulation results to a Run named *sim1.run1.ex4.v1* using the **Save Run** button.

[®] Then go to Results Mode and select the Run *sim1.run1.ex4.v1* 

⁽¹⁾ Press the **Product View** button and then **Graph** or **Table** on the products you want to review the results.

now 10 ▼ entries	Search:			
Name ^	Unit	÷	Actio	ns 🍦
Caps	units		Graph	Table
Empty Bottles	units		Graph	Table
Filled Bottles	units		Graph	Table
Juice	liters		Graph	Table
Packaging Film	meters		Graph	Table
Packs of Bottles	units		Graph	Table
Polypropylene	Kg		Graph	Table
Sealed Bottles	units		Graph	Table
nowing 1 to 8 of 8 entries		Previous	1	Next

The following figure shows the graph of empty bottles at each moment of simulation time.



Press the **Carrier View** button and then **Graph** or **Table** on the Carriers you want to review the results.

Select Carrier				×
Carriers				
show 10 ▼ entr	ies	Search:		
Carrier Id 🔷 ^ 📥	Product Name 🛛 🔶	Product Unit	Actio	ns  🍦
2005	Polypropylene	Kg	Graph	Table
2006	Empty Bottles	units	Graph	Table
2007	Caps	units	Graph	Table
2008	Packaging Film	meters	Graph	Table
2009	Juice	liters	Graph	Table
2010	Filled Bottles	units	Graph	Table
2011	Sealed Bottles	units	Graph	Table
2012	Packs of Bottles	units	Graph	Table
howing 1 to 8 of 8	entries	Previous	5 1	Next
				Cancel

The following figure shows the graph of the amount of juice in Carrier 2009 at each moment of simulation time.

liters 9,000 - 8,000 - 5,000 - 5,000 - 3,000 - 1,000 - 1,000 - 0 -	05 4 4	12 PM	Car	rier: 20	09 - Ju	lice	06 PM	Wod 02	<u></u>
October	UO AIVI	12 PIVI	UO PIVI	Tue 02	UO AIVI	12 PW	UO PINI	wed 03	UO AIVI
October	06 AM	12 PM	06 PM	Tue 02	06 AM	12 PM	06 PM	Wed 03	06 AM

⁽¹⁾ Press the **Instant View** button, select the specific time of the simulation time in which you want to display the quantities of Products or Carriers.

[®] Press the **Outgoing Stocks** button to display the sales that were made or lost during the simulation time.

Sales Reliability:									
			in Quantities				in Orders		
Carrier		Lost	Fulfilled		Percentage (%)	Lost	Fulfilled		Percentage (%)
2012-Packs of Bottles		0	30		100.0 %	0	1		100.0 %
Outgoing Stocks: Show 10 • entries Search:									
Date & Time 🔿	•	Delay (in hou	ırs)		Carrier			Quantity 🔶	Unit 🔶
02-10-2018 22:00:00		0			2012-Packs of Bottles			30	units
Showing 1 to 1 of 1 entries Copy Excel CS	SV PDF	Print						Previ	ous 1 Next

[®] Press the **Excess Production** button to display any excess production during simulation time. During this simulation period, you notice that there is excess production of caps and empty bottles, which means that the Cap Molding Machine and the Bottle Molding Machine work unnecessarily and waste resources.

Results for Run: sim1.run1.ex4.v1 of Simulator: sim.ex4.v1								
Excess Production (products lost when pu	Excess Production (products lost when pushed to full carriers):							
Show 10 T entries			Search:					
Date & Time 🔿 🔺	From Machine	To Carrier $\prescript{0}$	Lost Quantity  🍦	Unit 🔶				
01-10-2018 06:00:00	Cap Moulding	2007 - Caps	21250	units				
01-10-2018 14:00:00	Bottle Moulding	2006 - Empty Bottles	9500	units				
01-10-2018 15:00:00	Bottle Moulding	2006 - Empty Bottles	9500	units				
02-10-2018 01:00:00	Bottle Moulding	2006 - Empty Bottles	9500	units				
02-10-2018 02:00:00	Bottle Moulding	2006 - Empty Bottles	9500	units				
02-10-2018 03:00:00	Bottle Moulding	2006 - Empty Bottles	9500	units				
02-10-2018 13:00:00	Bottle Moulding	2006 - Empty Bottles	9500	units				
02-10-2018 14:00:00	Bottle Moulding	2006 - Empty Bottles	9500	units				
02-10-2018 15:00:00	Bottle Moulding	2006 - Empty Bottles	9500	units				
Showing 1 to 9 of 9 entries Copy Excel CSV PD	F Print		Previo	us 1 Next				

[®] Press the **Idle Machines** button to display Machine idle times during the simulation time.

#### **INNOVET**

Total Idle Time: 108 hours



Idle Machines (not working due to lack of input products):

Show 10 🔻 entries			Search:
Date & Time 🔿 🔺	From Carrier 🔶	To Machine 🔶	Needed Quantity 👙 Unit 👙
01-10-2018 00:00:00	2007 - Caps	Bottle Sealing	5000 units
01-10-2018 00:00:00	2010 - Filled Bottles	Bottle Sealing	5000 units
01-10-2018 00:00:00	2006 - Empty Bottles	Juice Filling	5000 units
01-10-2018 00:00:00	2011 - Sealed Bottles	Packaging Mach.	3000 units
01-10-2018 00:00:00	2008 - Packaging Film	Packaging Mach.	250 meters
01-10-2018 01:00:00	2010 - Filled Bottles	Bottle Sealing	5000 units
01-10-2018 01:00:00	2011 - Sealed Bottles	Packaging Mach.	3000 units
01-10-2018 02:00:00	2010 - Filled Bottles	Bottle Sealing	5000 units
01-10-2018 02:00:00	2011 - Sealed Bottles	Packaging Mach.	3000 units
01-10-2018 03:00:00	2011 - Sealed Bottles	Packaging Mach.	3000 units
Showing 1 to 10 of 110 entries Copy Excel CSV	/ PDF Print		Previous 1 2 3 4 5 11 Next

[®] Press the Idle Humans button to display employees inactivity time intervals during simulation time.

Results for Run: sim1.run1.ex4.v1 of 9	Simulator: sim.ex4.v1			
Total Idle Humans: 83.0 hours				
7			-	
6	_			
4				
3 <b>—</b> 2 <b>—</b>	·		_	
1	—			
•				
Mon 00:00 Mon 06:00	J Mon 12:00 Mon 18:00 Tue 00:00 Tue 0	:00 Tue 12:00 Tue 18:00	wed 00:00 Wed 06:00	
Human Schedule				
Show 10 v entries				Search:
Persons ^	Work Start 🔶	Hours 🔶	From 🔶	То
2	08:00:00	8	01-10-2018	03-10-2018
2	13:00:00	4	01-10-2018	03-10-2018
2	17:00:00	8	01-10-2018	03-10-2018
5	00:00:00	8	01-10-2018	03-10-2018
Showing 1 to 4 of 4 entries Copy Excel	CSV PDF Print			Previous 1 Next

[®] Notice that there are long idle time intervals for both machines and staff. Nevertheless, there is also over-production of products. Correct the appropriate programs in Simulation Mode to eliminate the above problems in the production line.

#### 8.5 Fifth Educational Paradigm

This example concerns a production line that produces packed bread slices for toasts. The raw materials are flour, yeast, salt and water. Raw materials are imported into the dough mixer machine to create the dough. Then the dough is provided to the rolling machine. The rolled dough is passed to the dough divider machine. The dough pieces are molded in the moulder machine which produces the unbaked breads. The unbaked breads are baked in the oven and then sliced. At the final stage, slices of toast are packed into two types of package containing either 20 or 36 slices. For this example a simulation of 32 hours is proposed.



**Flow Chart** 

<b>Carriers Max Capacities</b>	Machines Specifications
Flour: 1.000 Kg	Dough Mixer Machine: Inputs: 4
<b>Yeast:</b> 10.000 g	<ul> <li>60 Kg of Flour</li> <li>500 g of Yeast</li> <li>200 g of Salt</li> </ul>
<b>Salt:</b> 10.000 g	25 liters of Water Outputs: 1     85 Kg of Dough
Water: 1.000 liters	Next Input Time: 15 min Production Time: 15 min Required Human: 1
<b>Dough:</b> 500 Kg	Rolling Machine:
Rolled Dough: 500 Kg	Outputs: 1     20 Kg of Dough     Outputs: 1
Pieces of Dough: 500 units	20 Kg of Rolled Dough Next Input Time: 5 min Production Time: 5 min
Unbaked Breads: 500 units	Required Human: 1
Breads: 500 units	Dough Divider Machine: Inputs: 1 • 20 Kg of Rolled Dough
Bread Slices: 2.000 units	Outputs: 1 • 20 Pieces of Dough Next Input Time: 5 min
Packaging Film: 50.000 cm	Production Time: 5 min Required Human: 1
20 Slices Pack: 4.000 units	Moulder: Inputs: 1
36 Slices Pack: 2.000 units	Outputs: 1 • 1 unit of Unbaked Bread
	Production Time: 1 min Required Human: 1
	Oven: Inputs: 1
	85 units of Unbaked Bread Outputs: 1
	85 units of Bread Next Input Time: 30 min
	Production Time: 30 min Required Human: 1
	Bread Slicer: Inputs: 1
	1 unit of Bread Outputs: 1     40 units of Bread Sliggs
	Next Input Time: 1 min Production Time: 1 min
	Required Human: 1
	Packaging Machine: Inputs: 2
	56 unit of Bread Slices     50 cm of Packaging Film
	• 1 unit of 20 Slices Pack
	1 unit of 36 Slices Pack Next Input Time: 1 min
	Production Time: 1 min Required Human: 1

# Table of Specifications

The following figure shows the Design of the above production line as it should be designed in Design Mode.



© Create a Design named *ex5* that depicts the above production line. Then create a Simulator and simulate the production line to produce 40 "20 Slices Packs" and 40 "36 Slices Packs" using as few resources as possible in both raw materials and human resources.

#### 8.6 Sixth Educational Paradigm

In this example a quite large model is presented. It concerns the unload process of a cargo ship, that may contain wheat, corn, rice or rye. The flow chart of the process has as follows:



The model will be implemented by creating one Design containing 4 different production lines one for each product. The Machines and Carriers specifications for the production line of each product are presented in the following 4 tables.

<b><u>Carriers Initial / Max Capacities</u></b>	Machines Specifications
<b>Cargo :</b> 50000 / 50000 Kg	Cranes:
<b>Transport Line 0 :</b> 0 / 10000 Kg	Inputs: 1, Outputs: 1, Next Input Time: 1 min, Process Time 1 min, Required Humans: 1. Inputs: 3000 Kg
Transport Line 1 : 0 / 12000 Kg	Outputs: 3000 Kg
<b>Transport Line 2 :</b> 0 / 12000 Kg	<b>Splitting Machine:</b> Inputs: 1, Outputs: 3, Next Input Time: 1 min, Process Time 1 min / 1
<b>Transport Line 3 :</b> 0 / 12000 Kg	min / 1 min, Required Humans: 0. Inputs: 6000 Kg

#### Wheat Production Line Specifications

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Transport Line 4 : 0 / 80 Units	Outputs: 2000 Kg / 2000 Kg / 2000 Kg
Transport Line 5 : 0 / 80 Units	<b>Filling Sack Machine (1,2,3):</b> Inputs: 2, Outputs: 1, Next Input Time: 2 min, Process Time 2 min,
Transport Line 6:0/80 Units	Required Humans: 1. Inputs: 40 Units, 1600 Kg
Transport Line 7 : 0 / 3 Units	Outputs: 40 Units
Transport Line 8:0/3 Units	Palette Loader (1,2,3): Inputs: 2, Outputs: 1, Next Input Time: 2 min, Process Time 2 min,
Transport Line 9:0/3 Units	Required Humans: 0. Inputs: 1 Unit, 40 Units
Sack Warehouse : 10000 / 80000 Units	Outputs: 1 Unit
Palette Warehouse (1,2,3) : 1000 / 1000 Units	Wrapping Machine Type 1: Inputs: 2 Outputs: 1, Next Input Time: 2 min. Process Time 2 min.
Sack Feeding Line : 500 / 500 Units	Required Humans: 0. Innuts: 17 m 1 Unit
Final Product : 0 / 8 Units	Outputs: 1 Unit
Stored Final Products 1:0/400 Units	Wrapping Machine Type 2: Inputs: 2 Outputs: 1 Next Input Time: 1 min Process Time 1 min
Stored Final Products 2:0/350 Units	Required Humans: 0. Innuts: 6 m 1 Unit
<b>Film Type 1 :</b> 2000 / 2000 m	Outputs: 1 Unit
<b>Film Type 2 :</b> 840 / 840 m	Warehouse Placer: Inputs: 1 Outputs: 1 Next Input Time: 1 min Process Time 1 min
<b>Film Warehouse:</b> 20000 / 20000 m	Required Humans: 1. Inputs 1 Unit
Back Up Line : 0 / 4 Units	Outputs: 1 Unit
	Sack Replenisher: Inputs: 1, Outputs: 3, Next Input Time: 1 min, Process Time 1 min / 1 min / 1 min, Required Humans: 0. Inputs: 450 Units Outputs: 150 Units / 150 Units / 150 Units
	Palette Replenisher:         Inputs: 1, Outputs: 1, Next Input Time: 1 min, Process Time 1 min,         Required Humans: 0.         Inputs: 15 Units         Outputs: 15 Units
	Film Replenisher: Inputs: 1, Outputs: 3, Next Input Time: 10 min, Process Time 10 min / 10 min / 10 min, Required Humans: 1. Inputs: 4840 m Outputs: 2000 m / 2000 m / 840 m

#### **Corn Production Line Specifications**

<b>Carriers Initial / Max Capacities</b>	<b>Machines Specifications</b>
Cargo: 80000 / 80000 Kg	Cranes:
<b>Transport Line 0 :</b> 0 / 10000 Kg	Inputs: 1, Outputs: 1, Next Input Time: 1 min, Process Time 1 min, Required Humans: 1. Inputs: 3000 Kg
Transport Line 1 : 0 / 12000 Kg	Outputs: 3000 Kg
<b>Transport Line 2 :</b> 0 / 12000 Kg	Splitting Machine:
Transport Line 3 : 0 / 12000 Kg	min / 1 min, Required Humans: 0. Inputs: $6000 \text{ K}\sigma$
Transport Line 4 : 0 / 80 Units	Outputs: 2000 Kg / 2000 Kg / 2000 Kg
Transport Line 5 : 0 / 80 Units	Filling Sack Machine (1,2,3): Inputs: 2, Outputs: 1, Next Input Time: 2 min, Process Time 2 min,

Transport Line 6 : 0 / 80 Units	Required Humans: 1. Inputs: 40 Units, 1600 Kg Outputs: 40 Units
Transport Line 8 : 0 / 3 Units	Palette Loader (1,2,3):
Transport Line 9:0/3 Units	Required Humans: 0. Inputs: 1 Unit 40 Units
Sack Warehouse : 10000 / 80000 Units	Outputs: 1 Unit
Palette Warehouse (1,2,3) : 1000 / 1000 Units	Wrapping Machine Type 1: Inputs: 2, Outputs: 1, Next Input Time: 3 min, Process Time 3 min,
Sack Feeding Line : 500 / 500 Units	Required Humans: 0. Inputs: 17 m, 1 Unit
Final Product : 0 / 8 Units	Outputs: 1 Unit
Stored Final Products 1:0/400 Units	Wrapping Machine Type 2: Inputs: 2, Outputs: 1, Next Input Time: 1 min, Process Time 1 min,
Stored Final Products 2 : 0 / 350 Units	Required Humans: 0. Inputs: 6 m, 1 Unit
<b>Film Type 1 :</b> 2000 / 2000 m	Outputs: 1 Unit
<b>Film Type 2 :</b> 840 / 840 m	Warehouse Placer: Inputs: 1, Outputs: 1, Next Input Time: 1 min, Process Time 1 min,
<b>Film Warehouse:</b> 20000 / 20000 m	Required Humans: 1. Inputs: 1 Unit
Back Up Line : 0 / 3 Units	Outputs: 1 Unit
	Sack Replenisher: Inputs: 1, Outputs: 3, Next Input Time: 1 min, Process Time 1 min / 1 min / 1 min, Required Humans: 0. Inputs: 450 Units Outputs: 150 m / 150 m / 150 m
	<b>Palette Replenisher:</b> Inputs: 1, Outputs: 1, Next Input Time: 1 min, Process Time 1 min, Required Humans: 0. Inputs: 15 Units Outputs: 15 Units
	Film Replenisher: Inputs: 1, Outputs: 3, Next Input Time: 10 min, Process Time 10 min / 10 min / 10 min, Required Humans: 1. Inputs: 4840 m Outputs: 2000 m / 2000 m / 840 m

# **Rice Production Line Specifications**

<b>Carriers Initial / Max Capacities</b>	Machines Specifications
<b>Cargo :</b> 75000 / 75000 Kg	Cranes:
<b>Transport Line 0 :</b> 0 / 10000 Kg	Inputs: 1, Outputs: 1, Next Input Time: 1 min, Process Time 1 min, Required Humans: 1. Inputs: 3000 Kg
Transport Line 1 : 0 / 12000 Kg	Outputs: 3000 Kg
<b>Transport Line 2 :</b> 0 / 12000 Kg	Splitting Machine:
Transport Line 3 : 0 / 12000 Kg	min / 1 min, Required Humans: 0.
Transport Line 4 : 0 / 80 Units	Outputs: 2000 Kg / 2000 Kg / 2000 Kg
Transport Line 5 : 0 / 80 Units	Filling Sack Machine (1,2,3): Inputs: 2 Outputs: 1 Next Input Time: 2 min. Process Time 2 min.
Transport Line 6 : 0 / 80 Units	Required Humans: 1. Inputs: 64 Units. 1600 Kg
Transport Line 7 : 0 / 3 Units	Outputs: 64 Units

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Transport Line 8 : 0 / 3 Units	Palette Loader (1,2,3):
Transport Line 9:0/3 Units	Required Humans: 0. Inputs: 1 Unit 64 Units
Sack Warehouse : 25000 / 80000 Units	Outputs: 1 Unit
Palette Warehouse (1,2,3) : 1000 / 1000 Units	Wrapping Machine Type 1:
Sack Feeding Line : 500 / 500 Units	Required Humans: 0. Inputs: 17 m, 1 Unit
Final Product : 0 / 8 Units	Outputs: 1 Unit
Stored Final Products 1:0/400 Units	Wrapping Machine Type 2: Inputs: 2. Outputs: 1. Navt. Input. Time: 1. min. Process. Time. 1. min.
Stored Final Products 2 : 0 / 350 Units	Required Humans: 0. Inputs: 6 m 1 Unit
<b>Film Type 1 :</b> 2000 / 2000 m	Outputs: 1 Unit
<b>Film Type 2 :</b> 840 / 840 m	Warehouse Placer:
<b>Film Warehouse:</b> 20000 / 20000 m	Required Humans: 1.
Back Up Line : 0 / 3 Units	Outputs: 1 Unit
	Sack Replenisher: Inputs: 1, Outputs: 3, Next Input Time: 1 min, Process Time 1 min / 1 min / 1 min, Required Humans: 0. Inputs: 450 Units Outputs: 150 Units / 150 Units / 150 Units
	Palette Replenisher: Inputs: 1, Outputs: 1, Next Input Time: 1 min, Process Time 1 min, Required Humans: 0. Inputs: 15 Units Outputs: 15 Units
	<b>Film Replenisher:</b> Inputs: 1, Outputs: 3, Next Input Time: 10 min, Process Time 10 min / 10 min, Required Humans: 1. Inputs: 4840 m Outputs: 2000 m / 2000 m / 840 m

# **Rye Production Line Specifications**

<b>Carriers Initial / Max Capacities</b>	Machines Specifications
<b>Cargo :</b> 195000 / 195000 Kg	Cranes:
<b>Transport Line 0 :</b> 0 / 10000 Kg	Inputs: 1, Outputs: 1, Next Input Time: 1 min, Process Time 1 min, Required Humans: 1. Inputs: 3000 Kg
Transport Line 1 : 0 / 12000 Kg	Outputs: 3000 Kg
<b>Transport Line 2 :</b> 0 / 12000 Kg	<b>Splitting Machine</b> : Inputs: 1. Outputs: 3. Next Input Time: 1 min. Process Time 1 min / 1
<b>Transport Line 3 :</b> 0 / 12000 Kg	min / 1 min, Required Humans: 0.
Transport Line 4:0/80 Units	Inputs: 6000 Kg Outputs: 2000 Kg / 2000 Kg / 2000 Kg
Transport Line 5 : 0 / 80 Units	Filling Sack Machine (1,2,3):
Transport Line 6 : 0 / 80 Units	Inputs: 2, Outputs: 1, Next Input Time: 3 min, Process Time 3 min, Required Humans: 1. Inputs: 64 Units, 1600 Kg
Transport Line 7 : 0 / 3 Units	Outputs: 64 Units
Transport Line 8 : 0 / 3 Units	Palette Loader (1,2,3): Inputs: 2, Outputs: 1, Next Input Time: 3 min, Process Time 3 min,
Transport Line 9:0/3 Units	Required Humans: 0. Inputs: 1 Unit, 64 Units

Sack Warehouse: 25000 / 80000 Units	Outputs: 1 Unit
Palette Warehouse (1,2,3) : 1000 / 1000 Units	Wrapping Machine Type 1:
Sack Feeding Line : 500 / 500 Units	Inputs: 2, Outputs: 1, Next Input Time: 3 min, Process Time 3 min, Required Humans: 0. Inputs: 17 m. 1 Unit
Final Product : 0 / 8 Units	Outputs: 1 Unit
Stored Final Products 1:0/400 Units	Wrapping Machine Type 2: Inputs: 2, Outputs: 1, Next Input Time: 1 min, Process Time 1 min,
Stored Final Products 2:0/350 Units	Required Humans: 0. Inputs: 6 m, 1 Unit
<b>Film Type 1 :</b> 2000 / 2000 m	Outputs: 1 Unit
<b>Film Type 2 :</b> 840 / 840 m	Warehouse Placer: Inputs: 1, Outputs: 1, Next Input Time: 1 min, Process Time 1 min,
Film Warehouse: 20000 / 20000 m	Required Humans: 1.
Back Up Line : 0 / 3 Units	Outputs: 1 Unit
	Sack Replenisher: Inputs: 1, Outputs: 3, Next Input Time: 1 min, Process Time 1 min / 1 min / 1 min, Required Humans: 0. Inputs: 450 Units Outputs: 150 Units / 150 Units / 150 Units
	Palette Replenisher: Inputs: 1, Outputs: 1, Next Input Time: 1 min, Process Time 1 min, Required Humans: 0. Inputs: 15 Units Outputs: 15 Units
	<b>Film Replenisher:</b> Inputs: 1, Outputs: 2, Next Input Time: 10 min, Process Time 10 min / 10 min, Required Humans: 1. Inputs: 2840 m Outputs: 2000 m / 840 m

The Design that should be implemented consists of 4 independent designs one for each unloading process. They are presented in the following 4 figures,.

# Design of wheat unloading process



# Design of corn unloading process



# Design of rice unloading process



# Design of rye unloading process



After saving the above Design in a Version go to Simulation Mode, create a new Simulator and implement tha Machine Schedule that is presented in the following Table:

_____

Machine ^	From $ eightharpoonup  in the second $	To	Action	าร
Crane 1.C	01-11-2018 08:45:00	01-11-2018 08:55:00	Modify	Delet
Crane 1.C	01-11-2018 09:02:00	01-11-2018 09:04:00	Modify	Delet
Crane 1.R	01-11-2018 10:45:00	01-11-2018 10:53:00	Modify	Delet
Crane 1.R	01-11-2018 11:12:00	01-11-2018 11:17:00	Modify	Delet
Crane 1.R	01-11-2018 11:43:00	01-11-2018 11:49:00	Modify	Delet
Crane 1.R	01-11-2018 12:13:00	01-11-2018 12:19:00	Modify	Delet
Crane 1.R	01-11-2018 12:37:00	01-11-2018 12:44:00	Modify	Delet
Crane 1.Ri	01-11-2018 09:30:00	01-11-2018 09:37:00	Modify	Delet
Crane 1.Ri	01-11-2018 09:51:00	01-11-2018 09:56:00	Modify	Delet
Crane 1.W	01-11-2018 08:00:00	01-11-2018 08:09:00	Modify	Delet
Crane 2.C	01-11-2018 08:45:00	01-11-2018 08:55:00	Modify	Delet
Crane 2.C	01-11-2018 09:02:00	01-11-2018 09:04:00	Modify	Delet
Crane 2.R	01-11-2018 10:45:00	01-11-2018 10:53:00	Modify	Delet
Crane 2.R	01-11-2018 11:12:00	01-11-2018 11:17:00	Modify	Delet
Crane 2.R	01-11-2018 11:43:00	01-11-2018 11:49:00	Modify	Delet
Crane 2.R	01-11-2018 12:13:00	01-11-2018 12:19:00	Modify	Delet
Crane 2.R	01-11-2018 12:37:00	01-11-2018 12:44:00	Modify	Delet
Crane 2.Ri	01-11-2018 09:30:00	01-11-2018 09:37:00	Modify	Delet
Crane 2.Ri	01-11-2018 09:51:00	01-11-2018 09:56:00	Modify	Delet
Crane 2.W	01-11-2018 08:00:00	01-11-2018 08:09:00	Modify	Delet
Filling Sacks 1.C	01-11-2018 08:48:00	01-11-2018 08:52:00	Modify	Delet
Filling Sacks 1.C	01-11-2018 08:56:00	01-11-2018 09:01:00	Modify	Delet
Filling Sacks 1.C	01-11-2018 09:06:00	01-11-2018 09:08:00	Modify	Delet
Filling Sacks 1.C	01-11-2018 09:10:00	01-11-2018 09:13:00	Modify	Delet
Filling Sacks 1.R	01-11-2018 10:47:00	01-11-2018 13:01:00	Modify	Delet
Filling Sacks 1.Ri	01-11-2018 09:32:00	01-11-2018 09:38:00	Modify	Delet
Filling Sacks 1.Ri	01-11-2018 09:40:00	01-11-2018 09:45:00	Modify	Delet
Filling Sacks 1.Ri	01-11-2018 09:47:00	01-11-2018 09:54:00	Modify	Delet
Filling Sacks 1.Ri	01-11-2018 09:57:00	01-11-2018 10:03:00	Modify	Delet
Filling Sacks 1.Ri	01-11-2018 10:05:00	01-11-2018 10:12:00	Modify	Delet

Filling Sacks 1.W	01-11-2018 08:03:00	01-11-2018 08:21:00	Modify	Delete
Filling Sacks 2.C	01-11-2018 08:48:00	01-11-2018 08:52:00	Modify	Delete
Filling Sacks 2.C	01-11-2018 08:56:00	01-11-2018 09:01:00	Modify	Delete
Filling Sacks 2.C	01-11-2018 09:06:00	01-11-2018 09:08:00	Modify	Delete
Filling Sacks 2.C	01-11-2018 09:10:00	01-11-2018 09:13:00	Modify	Delete
Filling Sacks 2.R	01-11-2018 10:47:00	01-11-2018 13:01:00	Modify	Delete
Filling Sacks 2.Ri	01-11-2018 09:32:00	01-11-2018 09:38:00	Modify	Delete
Filling Sacks 2.Ri	01-11-2018 09:40:00	01-11-2018 09:45:00	Modify	Delete
Filling Sacks 2.Ri	01-11-2018 09:47:00	01-11-2018 09:54:00	Modify	Delete
Filling Sacks 2.Ri	01-11-2018 09:57:00	01-11-2018 10:03:00	Modify	Delete
Filling Sacks 2.Ri	01-11-2018 10:05:00	01-11-2018 10:12:00	Modify	Delete
Filling Sacks 2.W	01-11-2018 08:03:00	01-11-2018 08:21:00	Modify	Delete
Filling Sacks 3.C	01-11-2018 08:48:00	01-11-2018 08:52:00	Modify	Delete
Filling Sacks 3.C	01-11-2018 08:56:00	01-11-2018 09:01:00	Modify	Delete
Filling Sacks 3.C	01-11-2018 09:06:00	01-11-2018 09:09:00	Modify	Delete
Filling Sacks 3.C	01-11-2018 09:10:00	01-11-2018 09:12:00	Modify	Delete
Filling Sacks 3.R	01-11-2018 10:47:00	01-11-2018 13:01:00	Modify	Delete
Filling Sacks 3.Ri	01-11-2018 09:32:00	01-11-2018 09:38:00	Modify	Delete
Filling Sacks 3.Ri	01-11-2018 09:40:00	01-11-2018 09:45:00	Modify	Delete
Filling Sacks 3.Ri	01-11-2018 09:47:00	01-11-2018 09:54:00	Modify	Delete
Filling Sacks 3.Ri	01-11-2018 09:57:00	01-11-2018 10:03:00	Modify	Delete
Filling Sacks 3.Ri	01-11-2018 10:05:00	01-11-2018 10:12:00	Modify	Delete
Filling Sacks 3.W	01-11-2018 08:03:00	01-11-2018 08:21:00	Modify	Delete
Machine_Splitter C	01-11-2018 08:46:00	01-11-2018 08:57:00	Modify	Delete
Machine_Splitter C	01-11-2018 09:02:00	01-11-2018 09:04:00	Modify	Delete
Machine_Splitter R	01-11-2018 10:46:00	01-11-2018 10:53:00	Modify	Delete
Machine_Splitter R	01-11-2018 11:12:00	01-11-2018 11:19:00	Modify	Delete
Machine_Splitter R	01-11-2018 11:43:00	01-11-2018 11:49:00	Modify	Delete
Machine_Splitter R	01-11-2018 12:13:00	01-11-2018 12:20:00	Modify	Delete
Machine_Splitter R	01-11-2018 12:38:00	01-11-2018 12:45:00	Modify	Delete
Machine_Splitter Ri	01-11-2018 09:31:00	01-11-2018 09:56:00	Modify	Delete
Machine_Splitter W	01-11-2018 08:01:00	01-11-2018 08:10:00	Modify	Delete

Palette Loader 1.C	01-11-2018 08:45:00	01-11-2018 09:02:00	Modify	Delete
Palette Loader 1.C	01-11-2018 09:04:00	01-11-2018 09:06:00	Modify	Delete
Palette Loader 1.C	01-11-2018 09:08:00	01-11-2018 09:16:00	Modify	Delete
Palette Loader 1.R	01-11-2018 10:50:00	01-11-2018 13:04:00	Modify	Delete
Palette Loader 1.Ri	01-11-2018 09:34:00	01-11-2018 10:18:00	Modify	Delete
Palette Loader 1.W	01-11-2018 08:04:00	01-11-2018 08:23:00	Modify	Delete
Palette Loader 2.C	01-11-2018 08:48:00	01-11-2018 09:02:00	Modify	Delete
Palette Loader 2.C	01-11-2018 09:04:00	01-11-2018 09:06:00	Modify	Delete
Palette Loader 2.C	01-11-2018 09:08:00	01-11-2018 09:16:00	Modify	Delete
Palette Loader 2.R	01-11-2018 10:50:00	01-11-2018 13:04:00	Modify	Delete
Palette Loader 2.Ri	01-11-2018 09:34:00	01-11-2018 10:18:00	Modify	Delete
Palette Loader 2.W	01-11-2018 08:04:00	01-11-2018 08:23:00	Modify	Delete
Palette Loader 3.C	01-11-2018 08:48:00	01-11-2018 09:15:00	Modify	Delete
Palette Loader 3.R	01-11-2018 10:50:00	01-11-2018 13:04:00	Modify	Delete
Palette Loader 3.Ri	01-11-2018 09:34:00	01-11-2018 10:18:00	Modify	Delete
Palette Loader 3.W	01-11-2018 08:04:00	01-11-2018 08:23:00	Modify	Delete
Palette Replenisher 1.R	01-11-2018 12:28:00	01-11-2018 12:29:00	Modify	Delete
Palette Replenisher 2.R	01-11-2018 12:28:00	01-11-2018 12:29:00	Modify	Delete
Palette Replenisher 3.R	01-11-2018 12:28:00	01-11-2018 12:29:00	Modify	Delete
Sack Replenisher R	01-11-2018 09:00:00	01-11-2018 09:03:00	Modify	Delete
Sack Replenisher R	01-11-2018 11:08:00	01-11-2018 11:11:00	Modify	Delete
Sack Replenisher R	01-11-2018 11:33:00	01-11-2018 11:37:00	Modify	Delete
Sack Replenisher R	01-11-2018 12:00:00	01-11-2018 12:03:00	Modify	Delete
Sack Replenisher R	01-11-2018 12:21:00	01-11-2018 12:24:00	Modify	Delete
Sack Replenisher R	01-11-2018 12:38:00	01-11-2018 12:41:00	Modify	Delete
Sack Replenisher Ri	01-11-2018 09:44:00	01-11-2018 09:46:00	Modify	Delete
Sack Replenisher Ri	01-11-2018 10:00:00	01-11-2018 10:02:00	Modify	Delete
Warehouse Placer C1	01-11-2018 08:51:00	01-11-2018 09:30:00	Modify	Delete
Warehouse Placer C2	01-11-2018 08:51:00	01-11-2018 09:20:00	Modify	Delete
Warehouse Placer R1	01-11-2018 10:56:00	01-11-2018 13:08:00	Modify	Delete
Warehouse Placer R2	01-11-2018 10:54:00	01-11-2018 13:07:00	Modify	Delete
Warehouse Placer Ri1	01-11-2018 09:38:00	01-11-2018 10:23:00	Modify	Delete
Warehouse Placer Ri2	01-11-2018 09:38:00	01-11-2018 10:23:00	Modify	Delete
Warehouse Placer W1	01-11-2018 08:00:00	01-11-2018 08:25:00	Modify	Delete
Warehouse Placer W2	01-11-2018 08:00:00	01-11-2018 08:25:00	Modify	Delete
Wrapping Machine Type 1 C1	01-11-2018 08:45:00	01-11-2018 09:30:00	Modify	Delete
Wrapping Machine Type 1 C2	01-11-2018 08:45:00	01-11-2018 09:30:00	Modify	Delete
Wrapping Machine Type 1 R1	01-11-2018 10:53:00	01-11-2018 13:07:00	Modify	Delete

Showing 1 to 100 of 109 entries

Previous 1 2 Next

#### Machines Schedule

how 100 ▼ entries Search:				
Machine ^	From 🔶	То 🔶	Action	ns 🔶
Wrapping Machine Type 1 Ri1	01-11-2018 09:34:00	01-11-2018 10:23:00	Modify	Delete
Wrapping Machine Type 1 Ri2	01-11-2018 09:34:00	01-11-2018 09:34:00	Modify	Delete
Wrapping Machine Type 1 W1	01-11-2018 08:05:00	01-11-2018 08:25:00	Modify	Delete
Wrapping Machine Type 1 W2	01-11-2018 08:05:00	01-11-2018 08:25:00	Modify	Delete
Wrapping Machine Type 1 W2	01-11-2018 08:05:00	01-11-2018 08:25:00	Modify	Delete
Wrapping Machine Type 2 C	01-11-2018 08:45:00	01-11-2018 09:20:00	Modify	Delete
Wrapping Machine Type 2 R	01-11-2018 10:53:00	01-11-2018 13:07:00	Modify	Delete
Wrapping Machine Type 2 Ri	01-11-2018 09:34:00	01-11-2018 10:20:00	Modify	Delete
Wrapping Machine Type 2 W	01-11-2018 08:05:00	01-11-2018 08:25:00	Modify	Delete
Showing 101 to 109 of 109 entries		Previous	1 2	Next

OK

# Create also the Human Schedule that is shown in the following figure

Add Human Schedule Line





Human Schedule

Show 10 V entries Search:						
Persons ^	Work Start 🔶	Hours 🍦	From 🌲	То	Action	ns 🔶
7	08:00:00	8	01-11-2018	01-11-2018	Modify	Delete

Showing 1 to 1 of 1 entries

Previous 1 Next

ОК

Run the Simulator and save the results by pressing the Save Run button. Then go to Results Mode and review some of the available results presenting functions:

















#### **INNOVET**

The amounts of products at the simulation time starting point:

_____

Product ^	Amount 💧	Unit
Back Up R Line 2	0	Unit(s)
Com	80000	Ка
Film Type 1	16000	m
Film Type 2	3360	m
Film Warehouse	76389	m
Final Product C	0	Unit(s)
Final Product R	0	Unit(s)
Final Product Ri	0	Unit(s)
Final Product W	0	Unit(s)
Full Palette C	0	Unit(s)
Full Palette R	0	Unit(s)
Full Palette Ri	0	Unit(s)
Full Palette W	0	Unit(s)
Full Sack C	0	Unit(s)
Full Sack R	0	unit(s)
Full Sack Ri	0	unit(s)
Full Sack W	0	Unit(s)
Palette	420	Unit(s)
Palette Warehouse 1	3944	Unit(s)
Palette Warehouse 2	3944	Unit(s)
Palette Warehouse 3	3936	Unit(s)
Rice	75000	Kg
Rye	195000	Kg
Sack C	11500	unit(s)
Sack R	26500	unit(s)
Sack Ri	26500	unit(s)
Sack W	16500	unit(s)
Stored Final Product Corn	0	Unit(s)
Stored Final Product Rice	0	Unit(s)
Stored Final Product Rye	0	Unit(s)
Stored Final Product Wheat	0	Unit(s)
Wheat	44000	Kg

# Date & Time: 01-11-2018 08:00:00
## INNOVET

The amounts of products at the simulation time ending point:

how 50 Tentries	Search:	
Product ^	Amount 🍦	Unit
Back Up R Line 2	0	Unit(s)
Corn	22400	Kg
Film Type 1	14521	m
Film Type 2	2784	m
Film Warehouse	76389	m
Final Product C	0	Unit(s)
Final Product R	0	Unit(s)
Final Product Ri	0	Unit(s)
Final Product W	0	Unit(s)
Full Palette C	0	Unit(s)
Full Palette R	0	Unit(s)
Full Palette Ri	0	Unit(s)
Full Palette W	0	Unit(s)
Full Sack C	0	Unit(s)
Full Sack R	192	unit(s)
Full Sack Ri	0	unit(s)
Full Sack W	0	Unit(s)
Palette	237	Unit(s)
Palette Warehouse 1	3929	Unit(s)
Palette Warehouse 2	3929	Unit(s)
Palette Warehouse 3	3921	Unit(s)
Rice	5400	Kg
Rye	8400	Kg
Sack C	9760	unit(s)
Sack R	18046	unit(s)
Sack Ri	23746	unit(s)
Sack W	15420	unit(s)
Stored Final Product Corn	18	Unit(s)
Stored Final Product Rice	36	Unit(s)
Stored Final Product Rye	105	Unit(s)
Stored Final Product Wheat	24	Unit(s)
Wheat	6800	Kg