

TRUE

TEMPORAL REASONING UNIVERSAL ELABORATION

True System dynamics software

MANUAL Part 50

Tutorial 01

Last release 2014/04/30

www.true-world.com

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I - INTRODUCTION

A) Overview of the tutorial

The tutorial has been designed to progressively teach you how to use TRUE. by following this course :

- ❑ you should have discover the main concepts explained in the manual Man01-Concept ; these are the concepts you need to lean and understand.

As you progress through the tutorial, if you want to get more details, see the other manuals, exercises... and workingwith... models.

B) Studied model

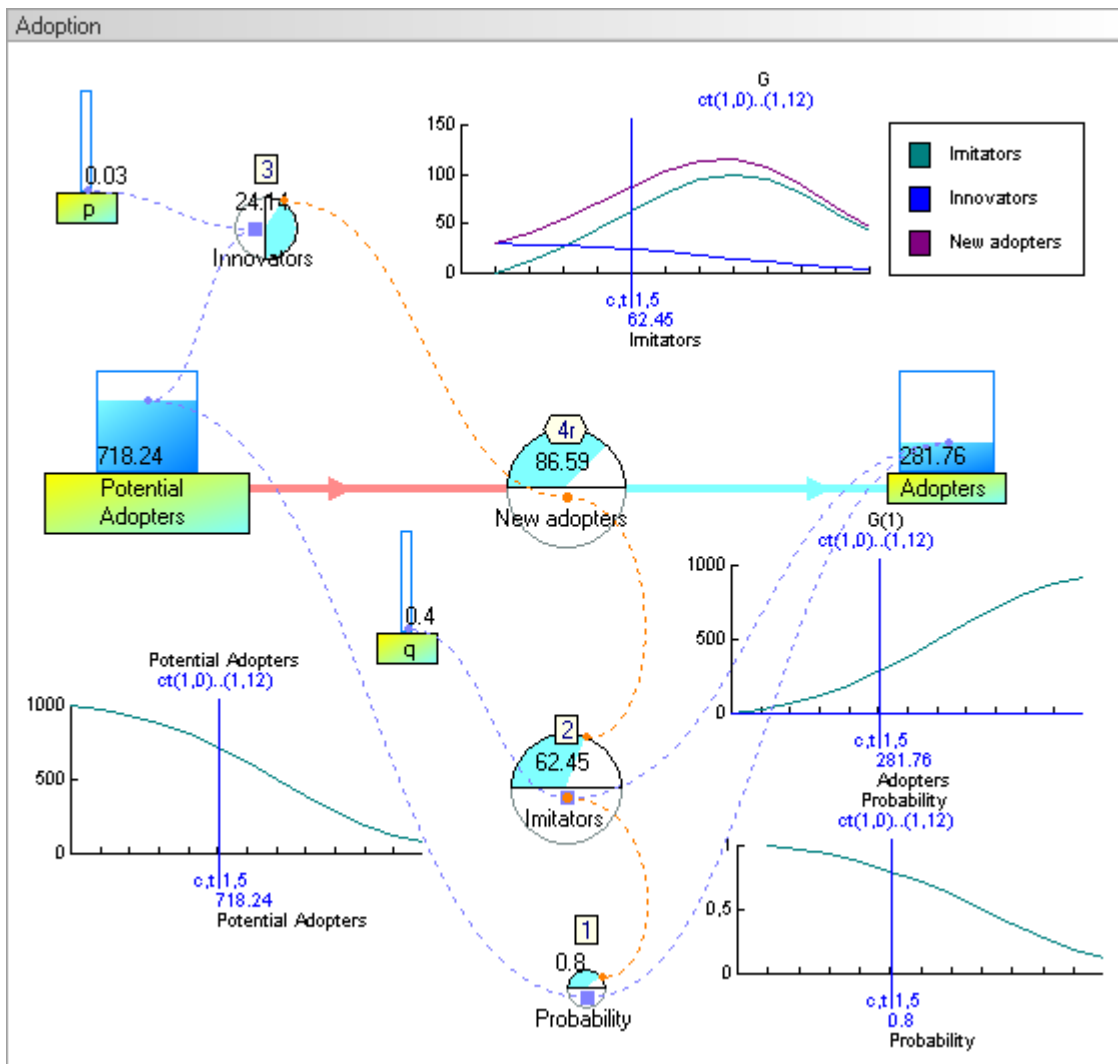
The studied model is 'New product adoption' :

- article by John Sterman (2001) Systems dynamics modeling :

- tools for learning in a complex world, California management review, Vol 43 no 1, Summer 2001

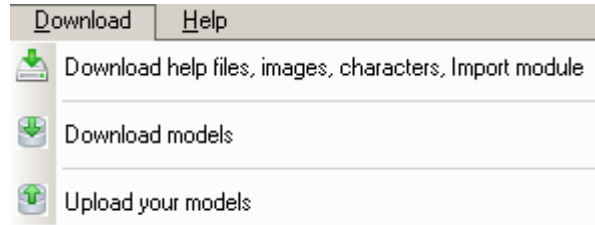
As an illustration of the use of system dynamics, imagine an organisation that plans to introduce an innovative new durable consumer product. The organisation needs to understand the possible market dynamics in order to design marketing and production plans.

<http://www.true-world.com/htm/en/adoption.htm>



II – MODEL

You can download this model with the main menu Download → Download models



A) Create a new empty model

- ❑ Run TRUE software
- ❑ Create a new empty model : press the keys : Ctrl+N

B) Save the model as

- ❑ To save the model as 'Tutorial Adoption' : press the keys : Ctrl+S
- ❑ Type 'Tutorial Adoption'
- ❑ Click on the 'Save' button

C) Settings

1. Initialize the temporality of the model :

- Main menu Model → Settings

Settings

Description Temporality Apply temporality Import

Blue parameters are only for information, they don't modify the model and output data

Number of cycle(c) **Label for c**
It is the cycle number you want to compile at last. starting from Year : 2014
While testing the model, it is faster to compute only one cycle

Nb of time unit(t) per cycle(c) **Label for t**
Total number of time unit(nbt) starting from Month : January
 $nbt(max) = t(max) \times c(max)$ It is the label for t=1, because t=0 is the past

Continuous time

TimeStepl **TIME_STEP = 1 / TimeStepl**

In continuous time, the TimeStepl should match the parameter 'Repeat'
Note: TimeStepl is equivalent to 1/TIME_STEP in Vensim

Default temporal parameters for the actions:
The model temporality is defined by the red parameters

Rate If enable, the stocks will be updated by the action result (result = y / TimeStepl) at the end of the time unit, before the transition to the next time unit (as in Vensim).
Rate is only effective if the flow links two stocks If disable, the stocks will be updated by the action result (result = y) immediately after the action has been calculated.

Chronology The parameters 'Start, Interval and Repeat define the number of time unit (t) per cycle

Random chronology The width of the default cycle will be determined by the action that will have the largest number of time units:
Start $t(max) = Start + (Interval \times (Repeat - 1))$

Interval

Repeat (nb of t per c)

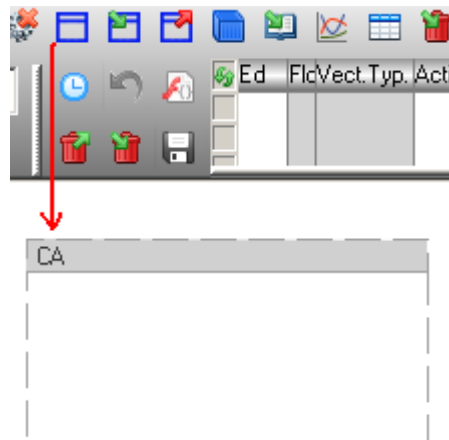
TimeTrue (=Time in True) = **TimeVensim (=Time in Vensim) =**

III – FRAME

A) Create a new frame

Creating this frame doesn't affect the results of the model, it is only for display.

- ❑ Click on the icon 'New Frame'
- ❑ Click in the background of the window
- ❑ Press the Escape key or right-click the mouse

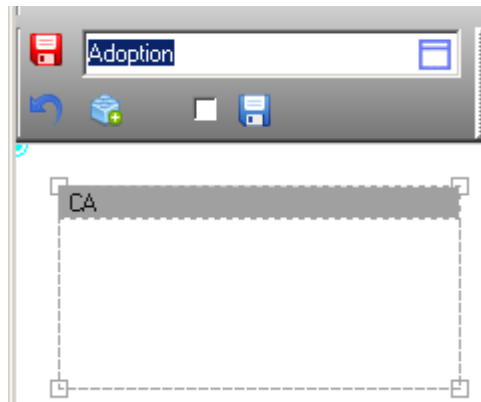


B) Setting the new frame

Rename the new frame :

- ❑ Click on the title bar of the frame
- ❑ Press the F2 key
- ❑ Type 'Adoption' then press the Enter key

- ❑ You can also rename the frame in the field below and click on the Save button



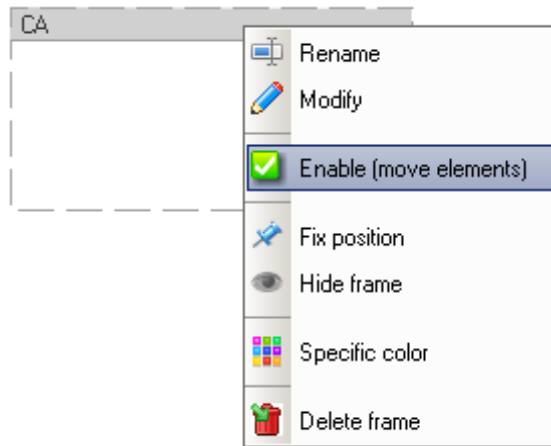
Resize the frame Adoption :

- ❑ Click on the right-bottom handle of the frame
- ❑ Drag this handle to resize the frame

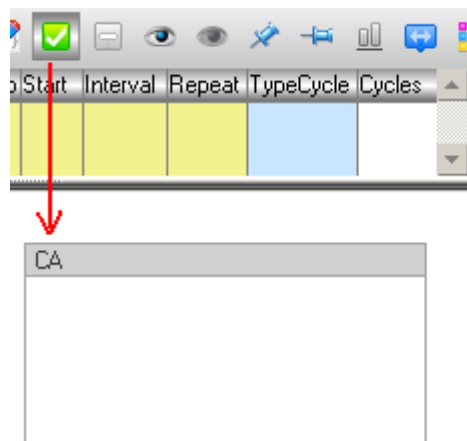
Enable the 'Move elements' option :

- ❑ Right-click on the title of the frame
- ❑ Select the 'Enable (move elements)' option

When you move the frame dragging its title bar, the elements inside will be moved too



- ❑ You can also click on the icon 'Enable'

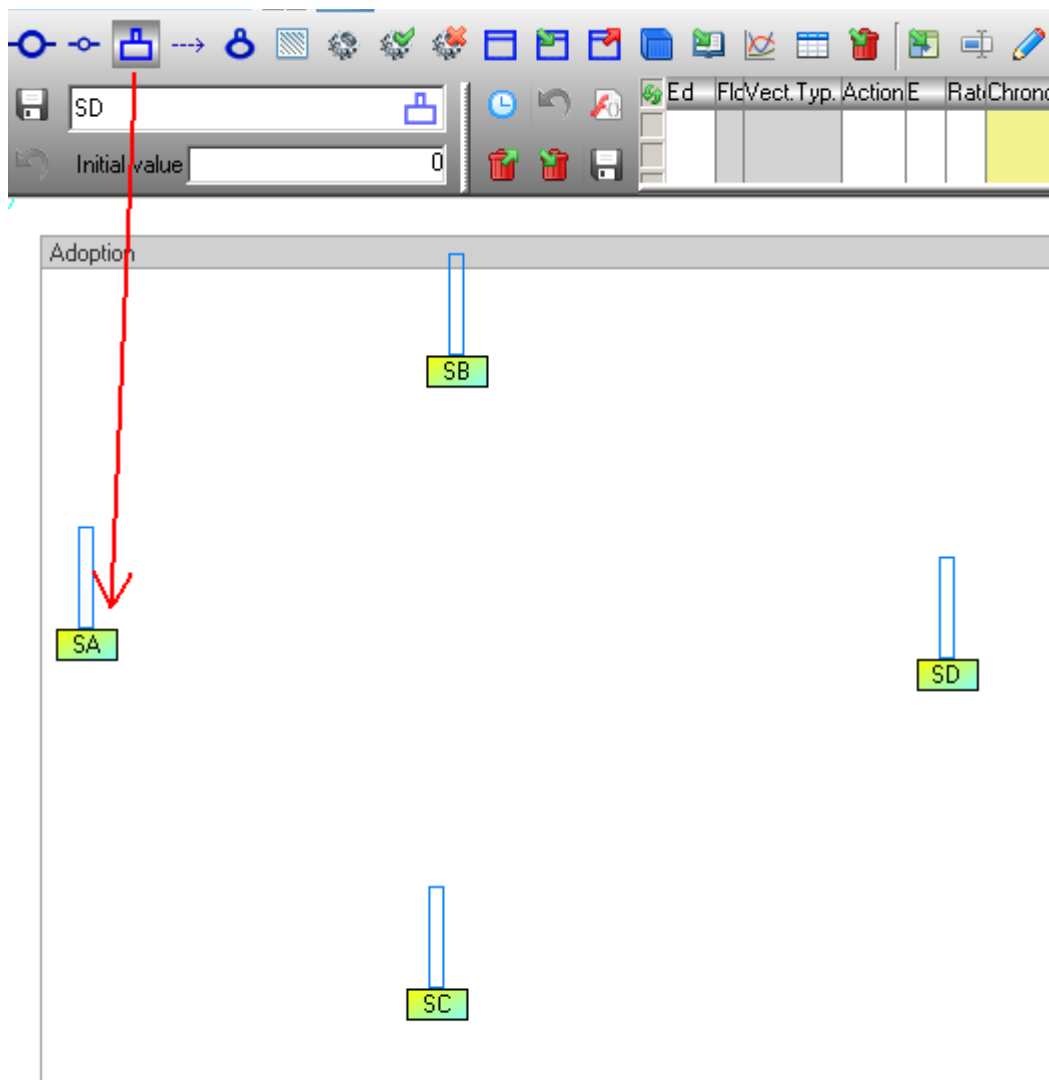


IV – STOCKS

A) Create new stocks

- ❑ Click on the 'New stock' icon
- ❑ Click in the frame 'Adoption' 4 times as in the figure below :
- ❑ Press the Escape key, or right-click the mouse when completed

By default, the names of the stocks are SA, SB, SC, SD → Stock SA, Stock SB, ...

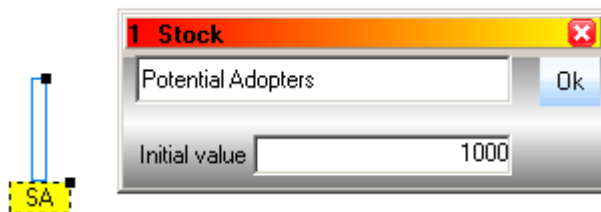


B) Setting the new stocks

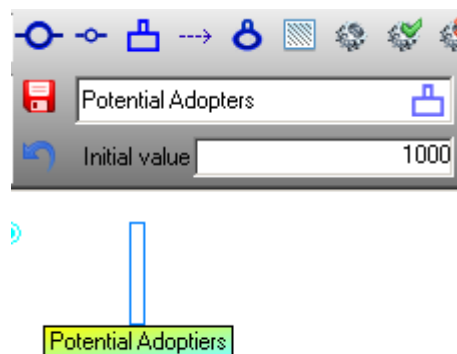
Rename the stock 'SA' and initialize its initial value :

The initial value is the first value of the stock, for time = 0, before starting calculation

- ❑ Click on the stock 'SA'
- ❑ Press the F2 or F3 key, or select the option Rename of the popup menu
- ❑ Type 'Potential adopters'
- ❑ Type in the field 'Initial value' : 1000
- ❑ press the Enter key or click on the button Ok

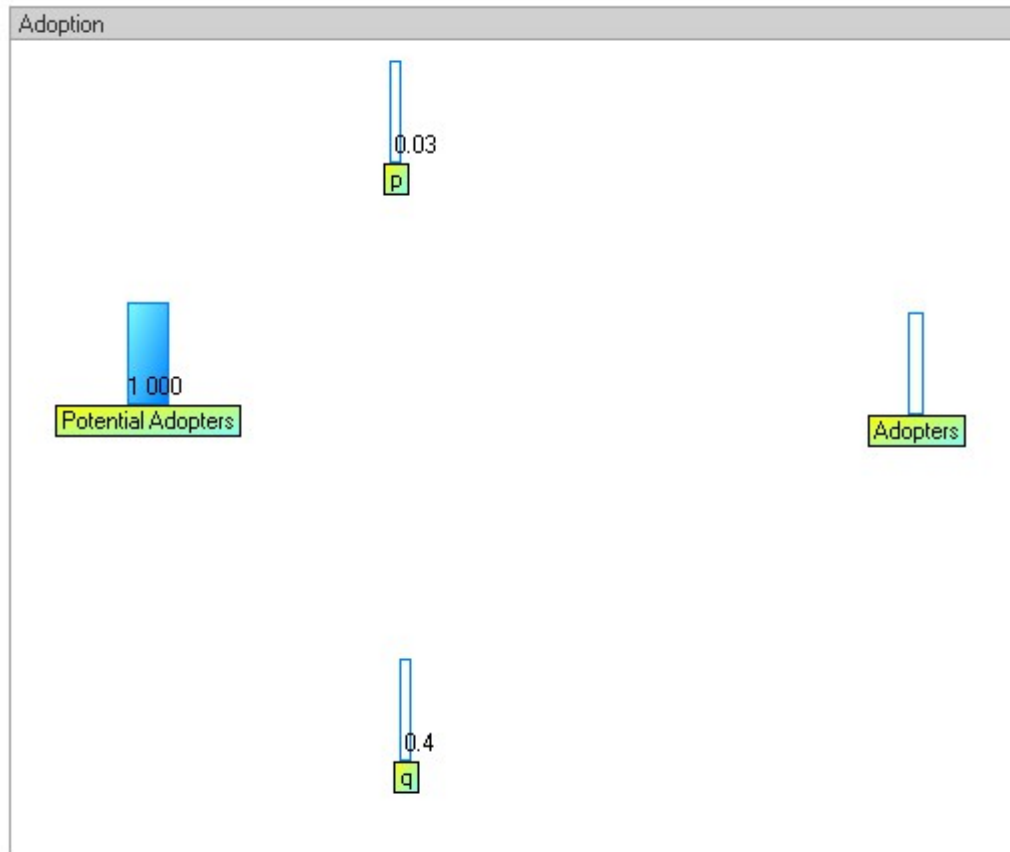


- ❑ You can also rename the stock in the field below, after selecting the stock



Rename and initialize the other stocks as following :

- ❑ stock SB → Adopters, initial value = 0
- ❑ stock SC → p, initial value = 0,03
- ❑ stock SD → q, initial value = 0,4



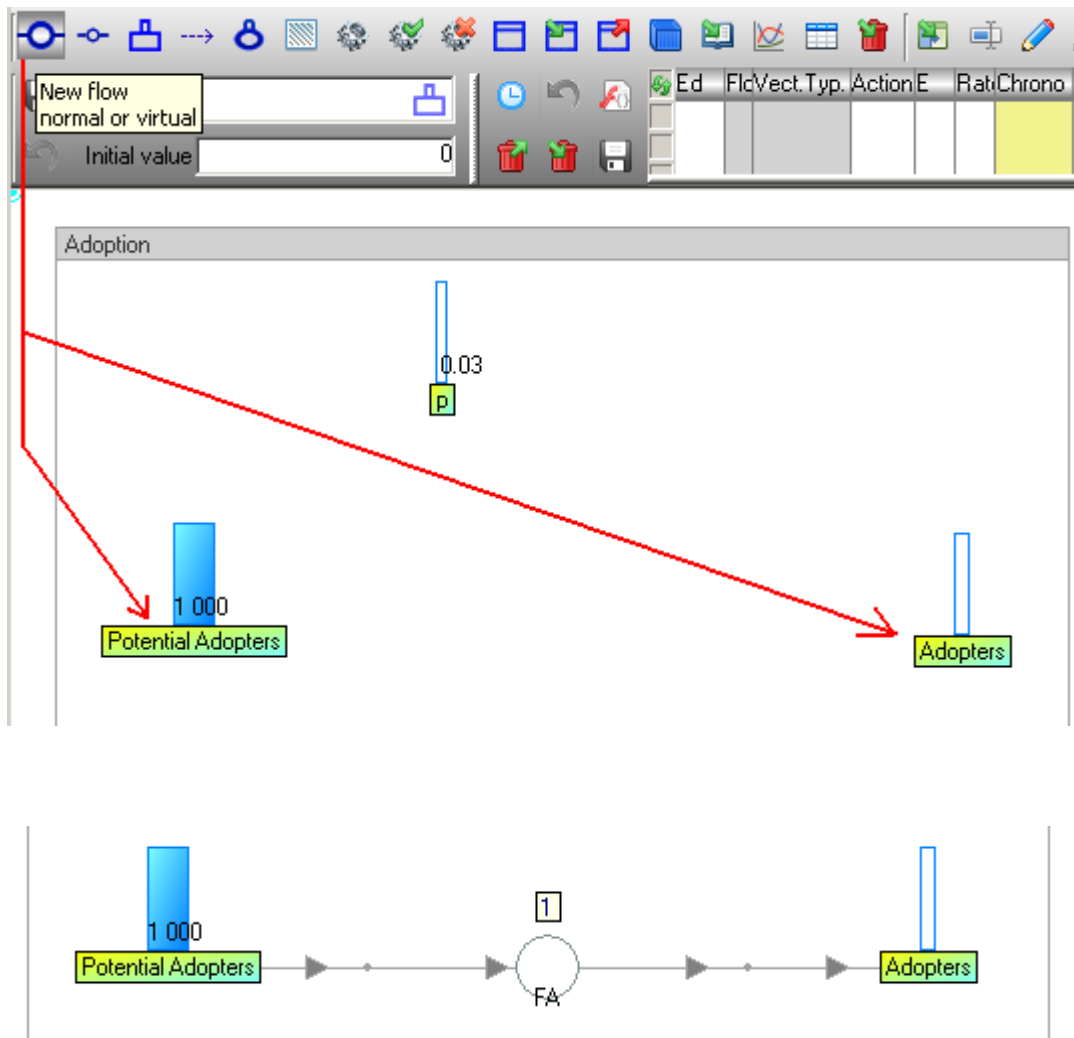
V – FLOWS

A flow links two stocks.

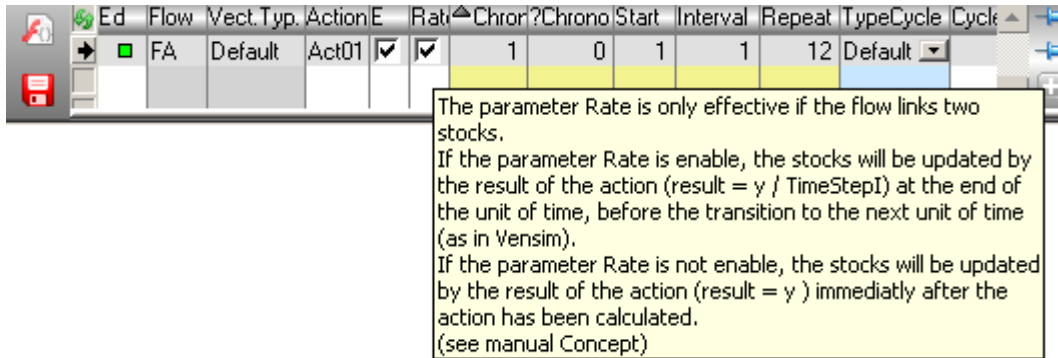
A flow that doesn't link two stocks is called a 'virtual flow' in TRUE software.

A) Create a new flow between two stocks

- ❑ Click on the icon 'New flow, normal or virtual'
- ❑ Click on the stock '**Potential adopters**' :
- ❑ Click on the stock '**Adopters**'
- ❑ Press the key Escape or right-click the mouse



- ❑ Select the flow 'FA'
- ❑ Enable the interrupt **Rate**
- ❑ click on the red button 'Save'

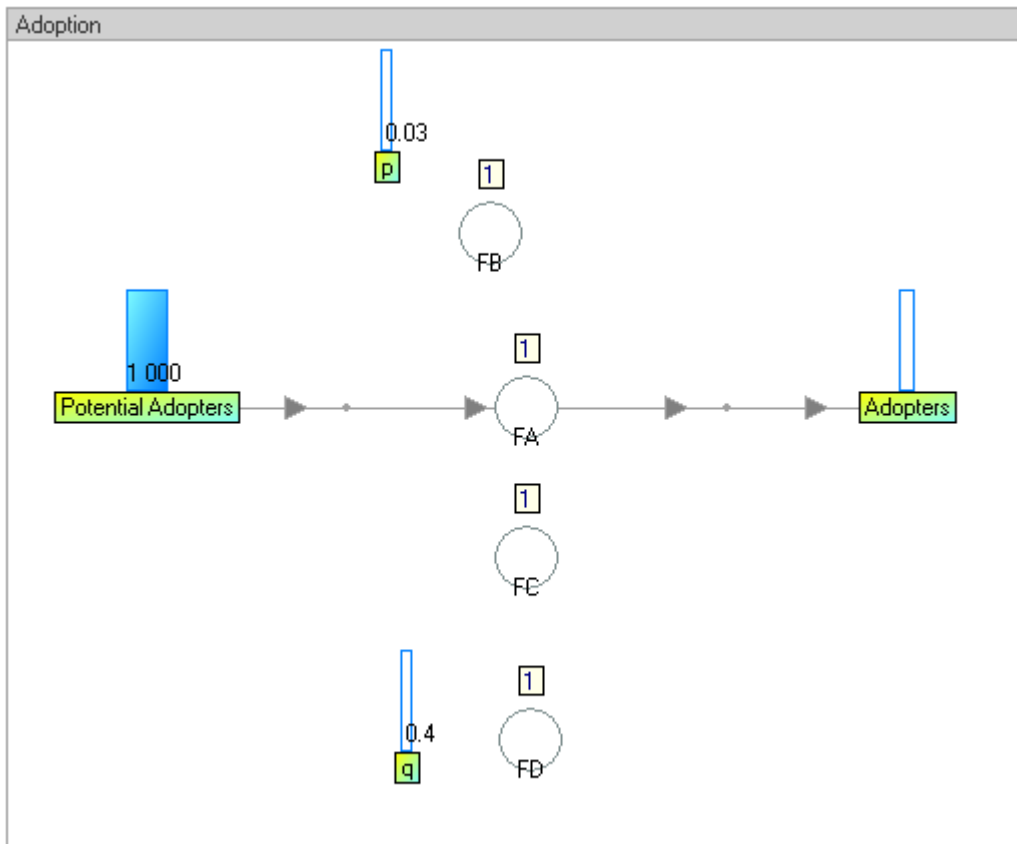


- ❑ The Rate parameter is enable to reproduce the Vensim software principle.

B) Create three new virtual flows

- ❑ Click on the icon 'New flow normal or virtual'
- ❑ Click on the model tree times as in the figure below
- ❑ Press the Escape key or right-click the mouse

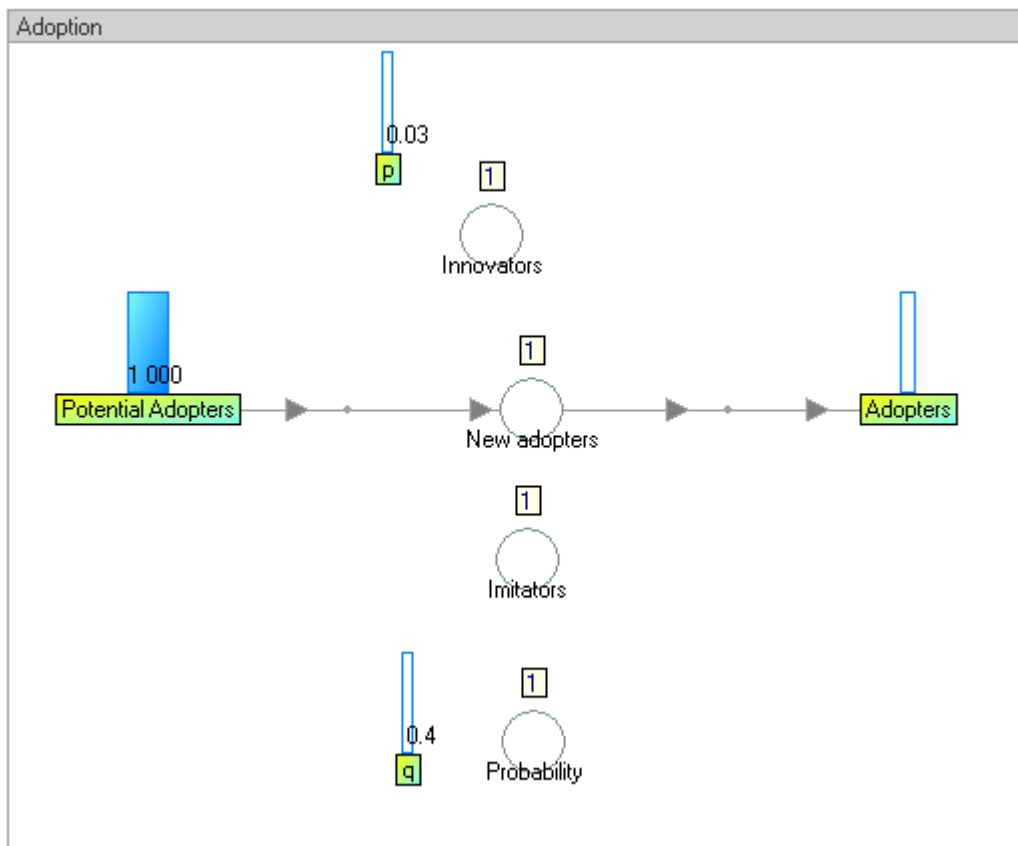
By default, the names of the virtual flows are FB, FC, FD → Virtual flow FB, Virtual flow FC,...



C) Rename the new flows

Rename the flows (same principle as Stock renaming, frame,...) :

- ❑ virtual flow FA → New adopters
- ❑ virtual flow FB → Innovators
- ❑ virtual flow FC → Imitators
- ❑ virtual flow FD → Probability

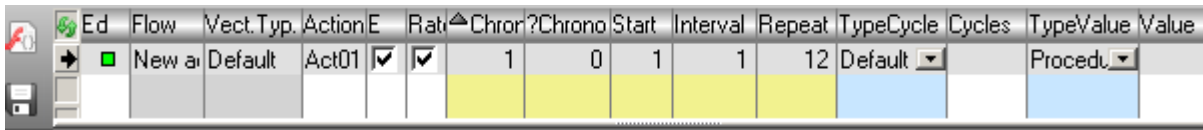


D) Setting the flows

Setting the flow 'New adopters' :

- ❑ Click on the 'New adopters' flow

The table under the tool bar is filled with the first action of the 'New adopters' flow



| Ed | Flow | Vect. | Typ. | Action | E | Rat | Chor? | Chrono | Start | Interval | Repeat | Type | Cycle | Cycles | Type | Value | Value |
|----|------|-------|---------|--------|---|-----|-------|--------|-------|----------|--------|---------|-------|--------|---------|-------|-------|
| → | ■ | New a | Default | Act01 | ✓ | ✓ | 1 | 0 | 1 | 1 | 12 | Default | | | Procedu | | |

By default, one action is created , with the following temporal parameters :

- Chronology = 1
- Start = 1
- Interval = 1
- Repeat = 12

That means that the action will be executed starting from the unit of time 1, every unit of time, to the unit of time 12.

According to the 'Settings' window where one unit of time is one month, this action will be executed every month of every year.

Note that one cycle is one 'year' in this case.

If the cell of the column 'Ed' is green, that means that the default action is not in editing mode.

Note : in Vensim software :

- ❑ There are no temporal parameters.
- ❑ All flows and variables are calculated for every unit of time.
- ❑ The order of calculation is automatic.

Note that in TRUE software :

- ❑ Temporal parameters of one action define exactly when it will be calculated.
- ❑ The order calculation of one action in one unit of time is defined by its parameter 'chronology'.

To learn more about that see 'Man05 - Actions'

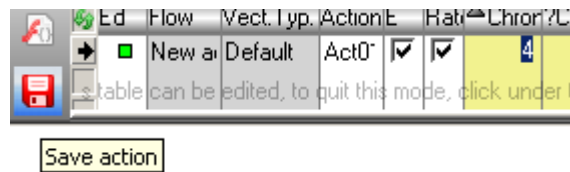
1. Setting the chronology

The parameter 'Chronology' determines when the action will be executed, that for each unit of time. In this model, the action of this flow 'New adopters' should be the latest action to be executed.

We can set the highest chronology to 4, because the model contains 4 flows.

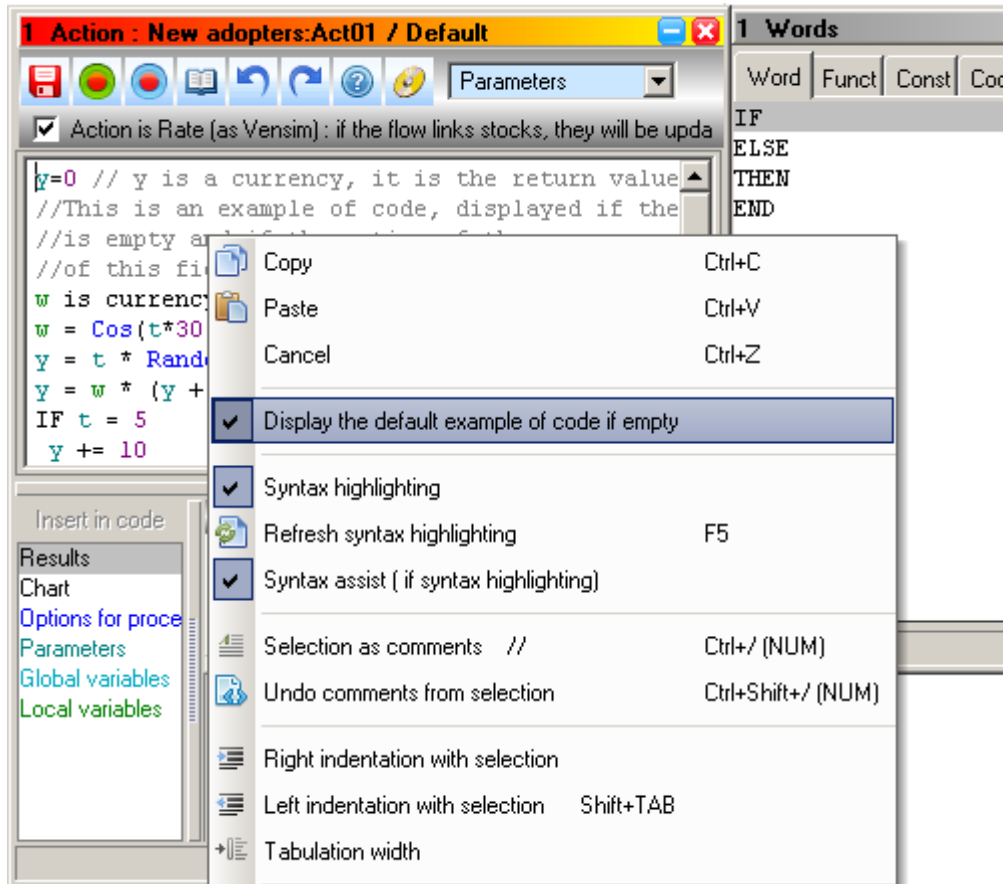
Setting the chronology to 4 : column Chrono = 4

- Click twice on the 'Chrono' cell in the default action line
- Type 4
- Click on the red button 'Save action'



2. Edit the procedure

Click on the green cell of the 'Ed' column of the default action line.
Now it turned red, that means that the default action is in edit mode.



The 'Action : ...' window is now open, it contains the default action procedure code of the 'New adopters' flow.

By default, a example of code is displayed.

Delete this code and unselect the option of the popup menu 'Display the default example of code if empty'
Press Ctrl+A then Delete keys.

The return value of the procedure is the value of the variable y.

By default, $y = 0$, and the action returns 0.

To learn more about this window see 'Man05 - Actions'

Type the code of the procedure

In this model, the value of the flow is equal to : $y = \text{Innovators} + \text{Imitators}$

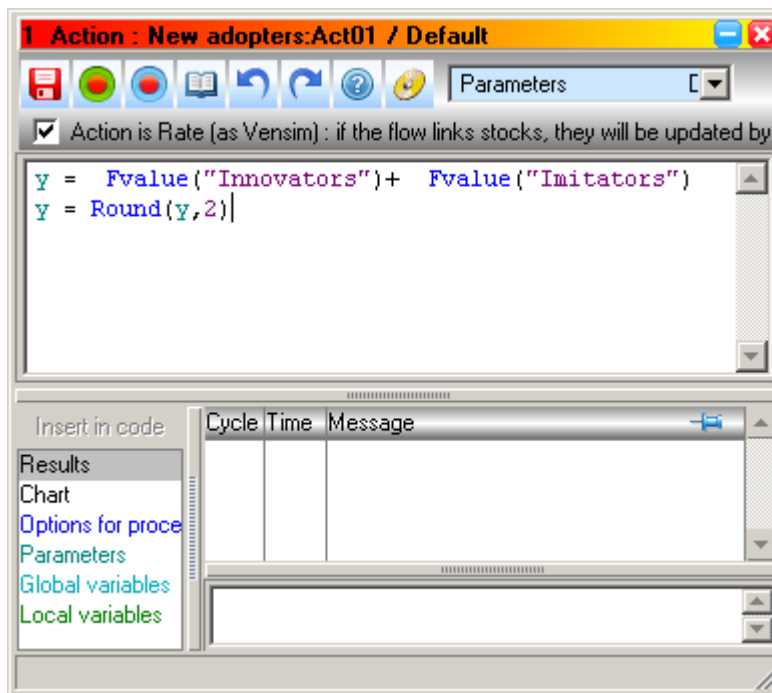
- Type the following code :

```
y = Fvalue("Innovators") + Fvalue("Imitators")
y = Round(y,2)
```

The function `Fvalue()` returns the current value of a flow

The function `Round()` limits the number of decimal of the variable, here y.

You can also drag and drop the flow 'Innovators' in this window instead typing the code `Fvalue("Innovators")`



- Click on the 'Save (Ctrl+S)' button or press Ctrl+S keys
- Click on the 'Close' button or press the Escape key

The two stocks '**Potential Adopters**' and '**Adopters**' will be updated by the return value **y** calculated by this code :

Potential Adopters - = **Potential Adopters** - **New adopters**
Adopters = **Adopters** + **New adopters**

3. Setting the virtual flows

Parameters of the following virtual flows :

Probability

- ❑ Chronology = 1
- ❑ Code :

```
pt,pta is currency
pt = Svalue("Potential Adopters")
pta = pt + Svalue("Adopters")

IF pta <> 0
  y = pt / pta
  y = Round(y,2)
END
```

Imitators

- ❑ Chronology = 2
- ❑ Code :

```
y = Svalue("q") * Svalue("Adopters") * Fvalue("Probability")
y = Round(y,2)
```

Innovators

- ❑ Chronology = 3
- ❑ Code :

```
y = Svalue("p") * Svalue("Potential Adopters")
y = Round(y,2)
```

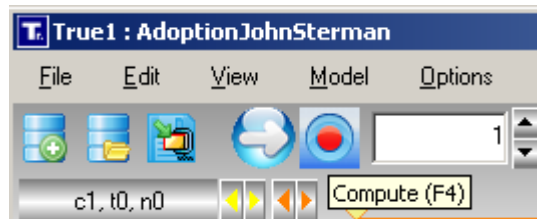
VI – COMPUTE THE MODEL

Note that the **blue** 'Compute (F4)' icon, under the main View menu, is enabled after creating the first stock.

If this button is enable, that means that the model is modified and you have to first compute it, or compute it again.

A) Compute the model for one cycle

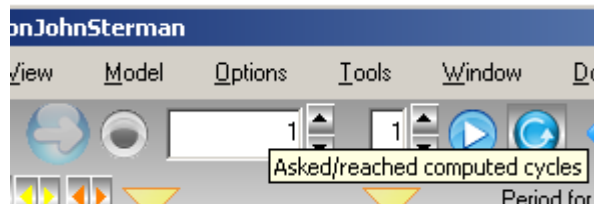
- ❑ Click on the blue 'Compute (F4)' icon



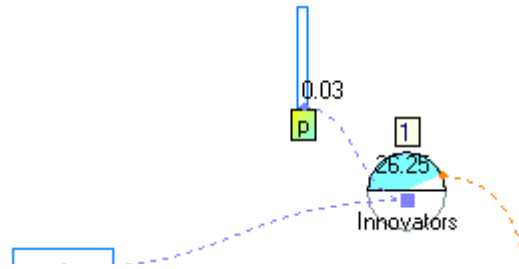
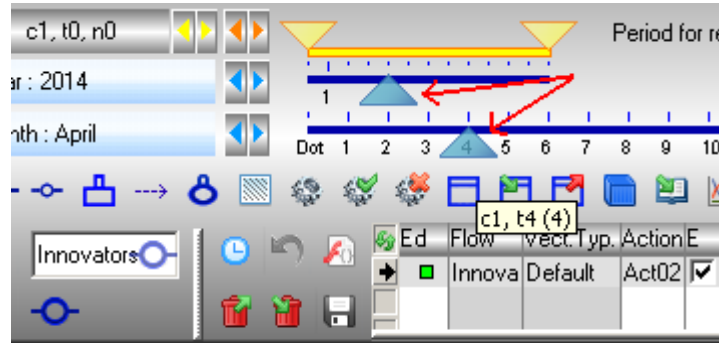
While computing, the icon is red.

After computing, the button is blue and disable.

If you want to compute the module for more than one cycle, enter the number of cycles in the 'Asked/reach computed cycles' field, and click on the 'Compute (F4)' icon.



To display the values of the elements for a specific time unit, move the blue cursors, or press the left or right arrow keys.

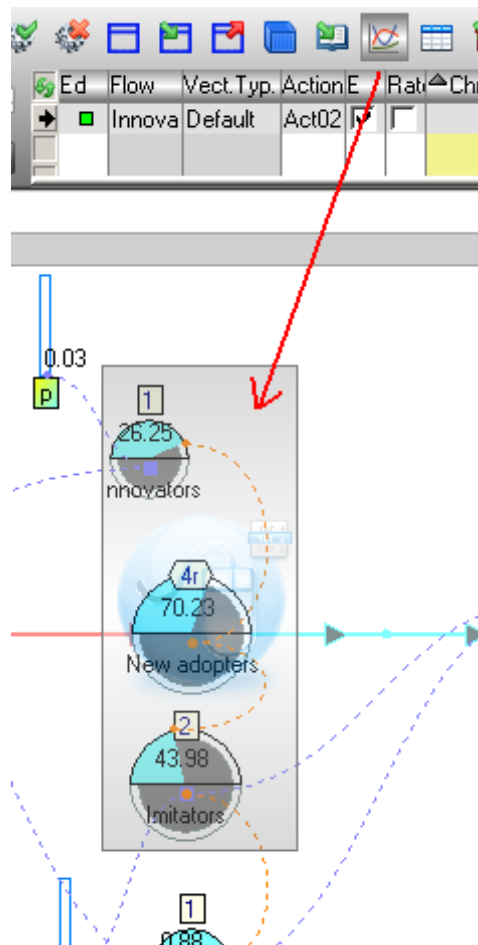


VII – CHARTS

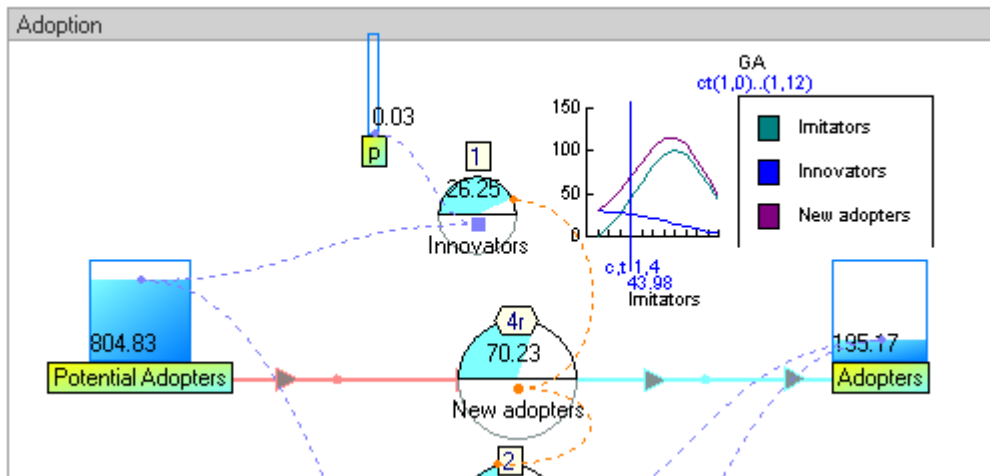
To learn more about charts see 'Man07 – Charts'

A) Create a chart for three flows

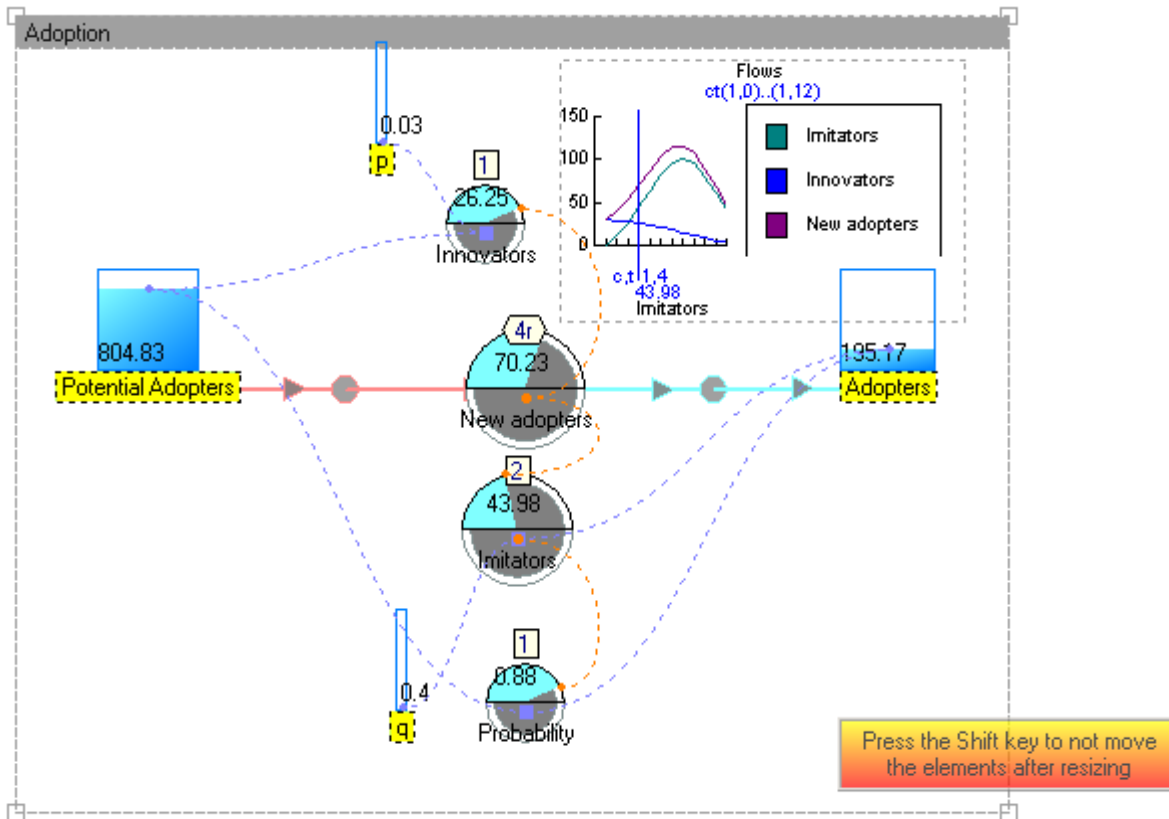
- ❑ Click on the 'New chart' icon of the tool bar
- ❑ With the mouse, draw a rectangle that contains the 3 flows : **Innovators**, **New adopters** and **Imitators**
- ❑ Click in the selection rectangle to create the new chart
- ❑ Press the Escape key or right-click on the background



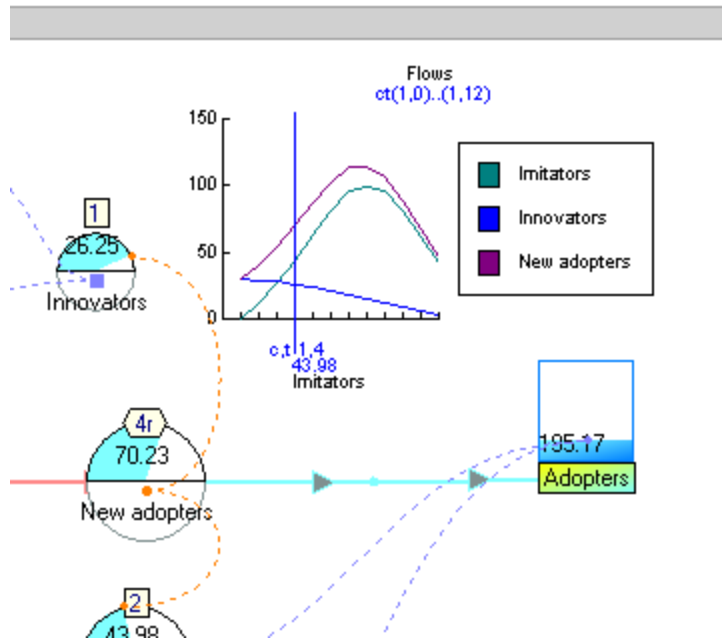
- Move the chart in the frame as below :



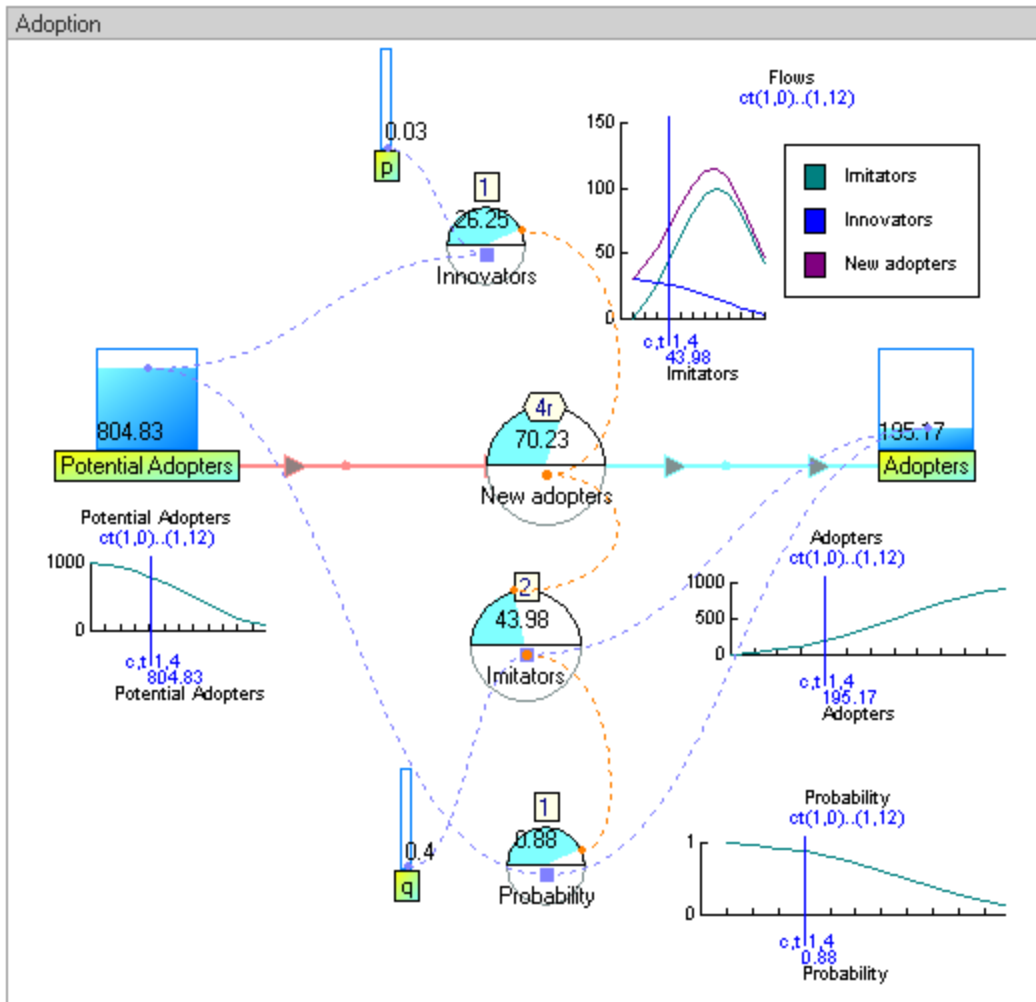
- Rename the chart : 'Flows'
- Click on the title bar of the frame and drag the right-bottom handle to enlarge the frame



- The elements inside the frame will be moved after resizing the frame



- Press the **G** key to align the elements in the model

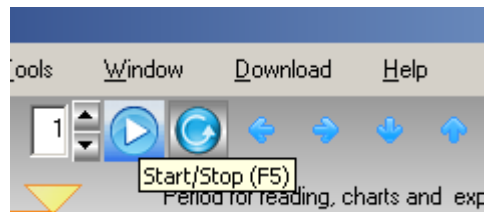


VIII – DISPLAY THE MODEL

A) Display the values of the model after computing

After computing, the values of the stocks and flows are displayed, according the selected unit of times

- ❑ Select the unit of time using the blue cursors,
- ❑ or with the Date buttons of the top toolbar,
- ❑ or with the left or right key of the keyboard (up or down for previous or next cycle)
- ❑ or click on the Start/Stop button or press F5



To learn more see 'Man02 – Model' chapter X