TEC.Planner

TECHNICAL & ECONOMICAL PERFORMANCE
amounts distribution system

Wih risk analysis - Adopting a Montecarlo Method

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ABSTRACT

Evaluation of the Technical & Economical curve. Risk analysis with Montecarlo method

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INTRODUCTION.

This tool has been developed as a cheaper alternative to the conventional tools currently available on the market.

It is not comparable to those tools such as Primavera Risk Analysis, Safrane and Crystal Ball.

The Tools require you to input some key data in order to run a Montecarlo analysis:

1. Enter the start and finish date for the tasks (control activities) in analysis, with the relative quantification in monetary terms, with the dedicated table view;

2. Record the previous analysis parameters, previous budget data, in order to been able to compare the current analysis (cost and production curves) with the previous one;

3. Input the weekly calendar and the holidays as per the specific customized country the analysis need to be run by;

4. Automatically assess the linear distribution over the defined control activities, time window (defined by their start and finish date and the assigned week and holiday pattern as per point 3 above);

5. Define up to a maximum of 6 attributes, e.g. if we refer to costs could be attributes such as Staff and consultancy, Fixed costs, Installations and decommissioning and Freight, Labor, Materials, Subcontracting; and

6. Perform the risk analysis based on the Montecarlo methodology. No results convergence analysis during the various iterations will be performed. Based on experience, in this version of the tool, the iterations have been pre-defined to 1000

TUTORIAL

A video showing the key functionalities of the tools can be found at:

https://youtu.be/bVDojGXPZ9s

a further video, showing step by step the process of the 4 analysis phases can be found at: (please, note that the whole process take about 13 minutes when running on a laptop with an i7 process at 2 Giga hertz

https://youtu.be/9suEURq1M2E

IMPORTANT: ENABLE THE VBA CODE WITHIN YOUR MsEXCEL SYSTEM

The tool has been developed using the Visual Basic for Application (VBA) within MsExcel.

In order for the tool to run, the VBA code need to be enabled in MsExcel.

1. Start MsExcel;

2. On the "Sheet", right click and select menu> Options> Trust center> Trust center setting; and

3. Activate the execution of the Macros.

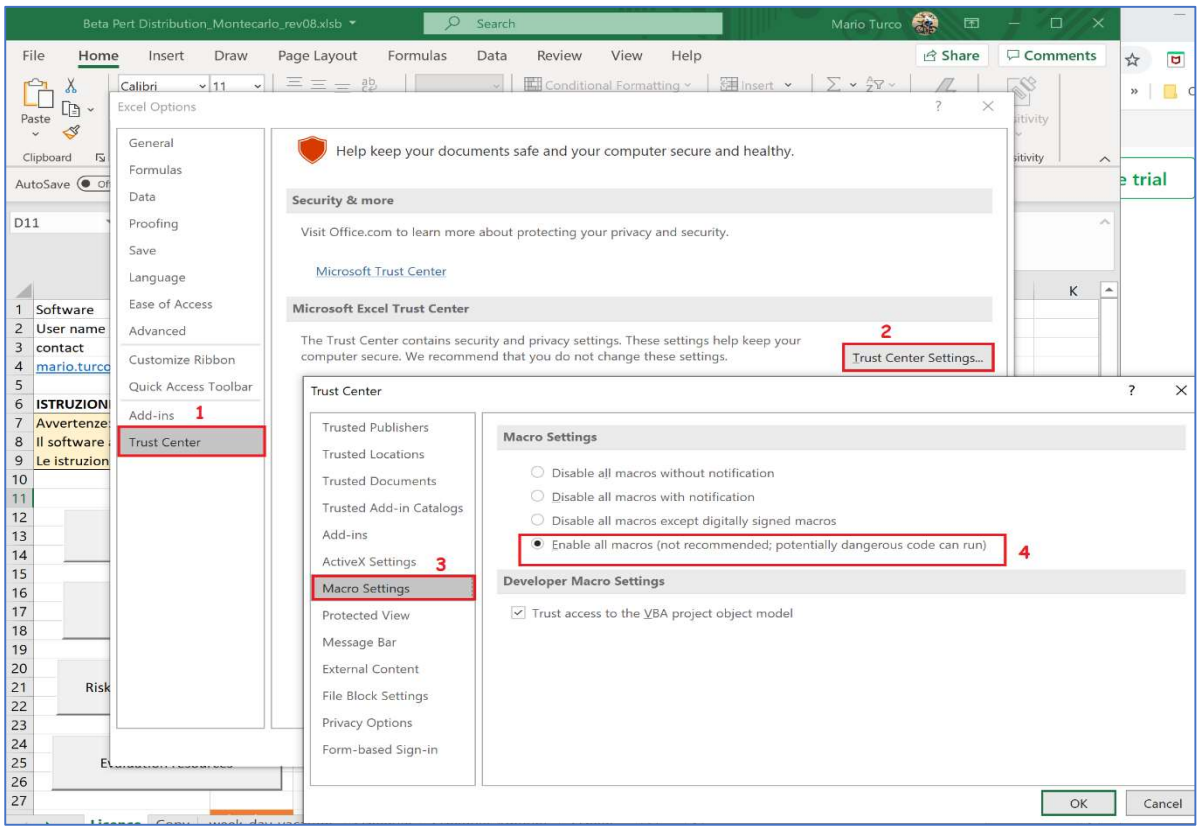


Figure 1 – Enabling Visual Basic for Appilcation in MsExcel

Close and start again MsExcel in order for the VBA to be active and run properly.

THE TOOL

The tool provided in this session is the demo version of the full functional version.

The demo is a working tool, all computational, charting, and other functionalities are fully functionality, up to the date stated in the tool itself (see introduction message box at the initialization of the Tool).

After such date, if you do want to continue to use it, you would need to purchase the time unlocked version of it.

DOWNLOAD THE TOOL

The tool time limited version (Demo Tool)can be downloaded, without any costs, at:
https://www.datamt.it/WS_Montecarlo.zip

SAVE THE TOOL ON YOUR MACHINE

After you downloaded the Demo Tool, normally in the "Download" folder, open the zip file and extract the MsExcel file in your desired working folder (the Tools does not work if run it by the Zip file).

You can save several copies of the Tool, each in different working folders as required by your working needs.

Please be ensured that all your work, and the relevant data does reside on your local machine and at no any time any data will be shared with any other system or users, above the one you decide to share by Email, Copies etc….

LUNCH THE TOOL

When you run the MsExcel file (Beta Pert Disrtibution_Montecarlo__rev08.xlsb), the Tool will read your computer system user name, and prompt it with a validity of the Tool itself, the user name extracted from the computer in use and the licensing status of the lunched copy.

Click "OK" and you will be presented with the "Tool Menu"

Figure 2 – Welcome Form at the lunch of the Tool

THE TOOL MENU

The Tool need to follow four phases, defined as:

- **Phase 1: Update the Works Days** – for the Montecarlo analysis and distribution of the monetary values within their start and finish dates based on working days;
- Phase 2: Calculation – Enter the deterministic data for the control activities ;
- **Phase 3: Evaluation Resources** – comparison between current and previous deterministic budget, and further breakdown in categories; and
- **Phase 4: Risk Analysis (Montecarlo)**- formal risk analysis based on the control activities and the risk parameters associated to them.

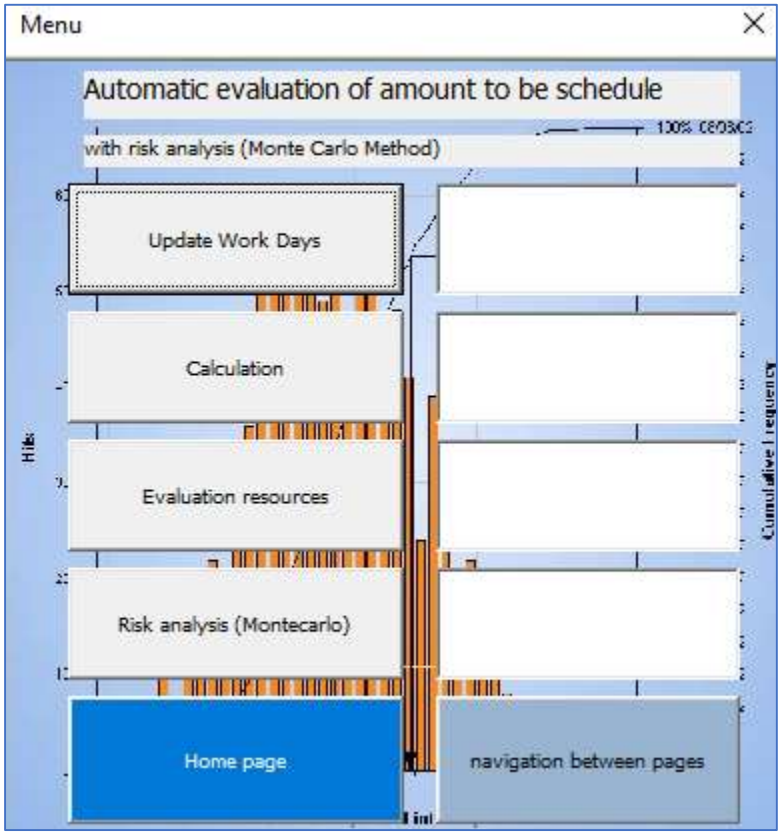


Figure 3 – Navigation Menu (four phases, Analysis pages).

This navigation menu can be evocated at any time by pressing “CTRL” and “a”.

From the menus is also possible to navigate between the various tab using the “navigation between pages” command button, that will open a navigation form.

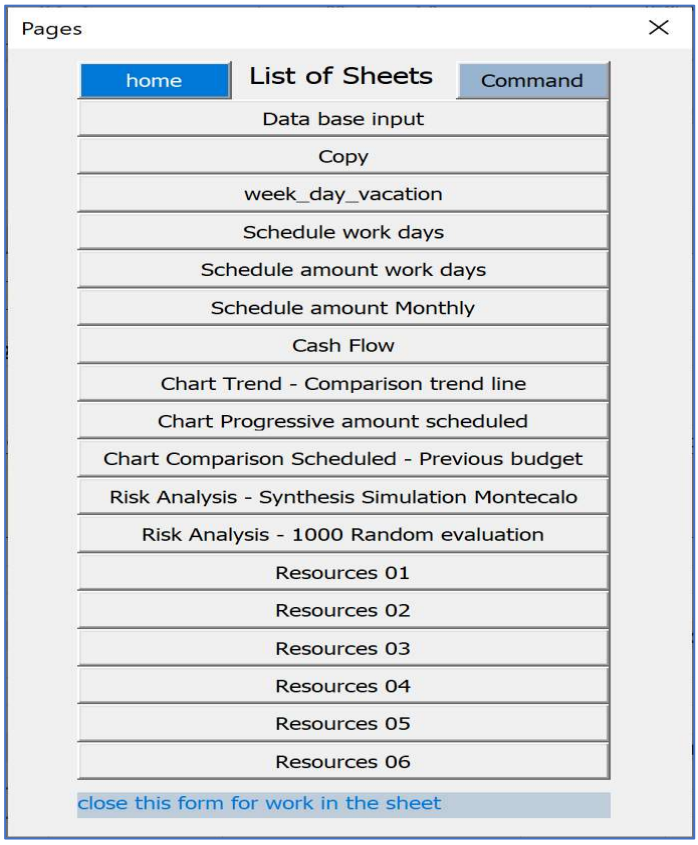


Figure 4 – Analysis pages navigation form.

The tabs navigation menu can be evocated at any time by pressing “CTRL” and “z”

PHASE 0 – KEY DATA INPUT

The Currency Definition

At the same time, during phase 1 the user would need to define which is the currency the analysis will be performed.

The currency is defined in the “License” tab in cell B5 (text achromous manually entered).

Please do note that, currently the Tool, does not perform any analysis on multiple currencies, and take in consideration the currency edging of project that have multiple currencies, this is a financial analysis that may be performed in other tools.

However in the case the user is currently working with a multi currencies project, he/she will need to pre convert all the data into a currency.

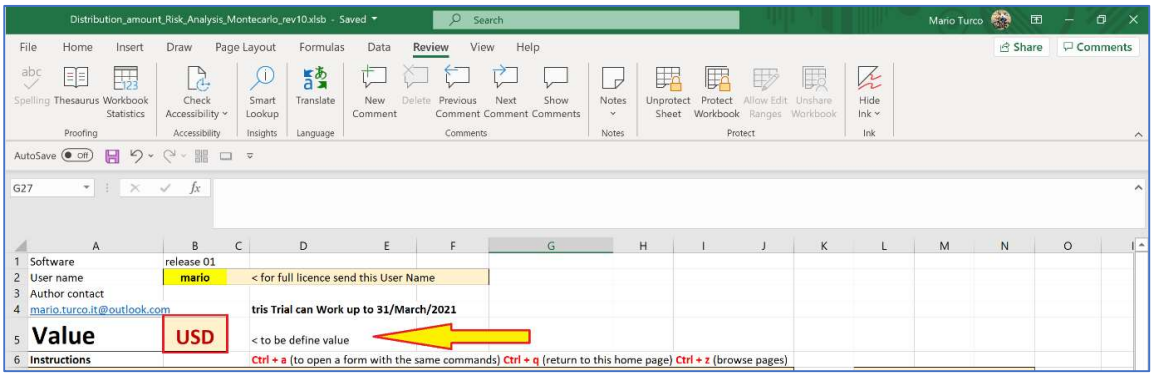
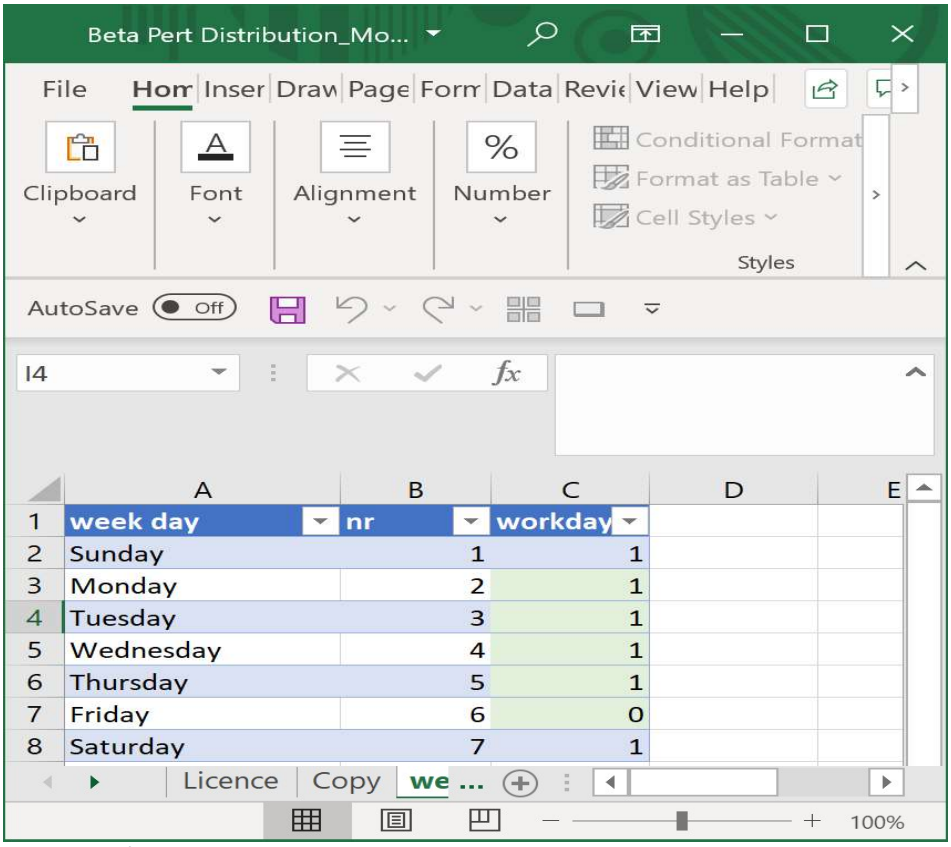


Figure 5 – Currency Definition

PHASE 1 – UPDATE THE WORK DAYS

Define the Working Week Pattern

This step in necessary later on, on the Montecarlo Analysis as well as on the deterministic distribution of the monetary amount based on the working pattern.
At first the holiday and working pattern need to be entered in the "**week_day_vacation**" tab



	A	B	C	D	E
1	week day	nr	workday		
2	Sunday	1	1		
3	Monday	2	1		
4	Tuesday	3	1		
5	Wednesday	4	1		
6	Thursday	5	1		
7	Friday	6	0		
8	Saturday	7	1		

Figure 6 – Week working / non working pattern definition

The user need to open the "**week_day_vacation**" sheet and define the working week type. Please bear in mind that "0" stand for non working day and "1" for working one.

Define the Annual Holiday Pattern

In the same tab from row 10 can also find, and populate accordingly, the holiday definition table.

This information need to be entered as

- Vacation – Name of holiday;
- Month – Month in which the vacation does occur;
- Day Start – First non Working day of the Holliday; and
- Day Finish - Last non Working day of the Holliday.

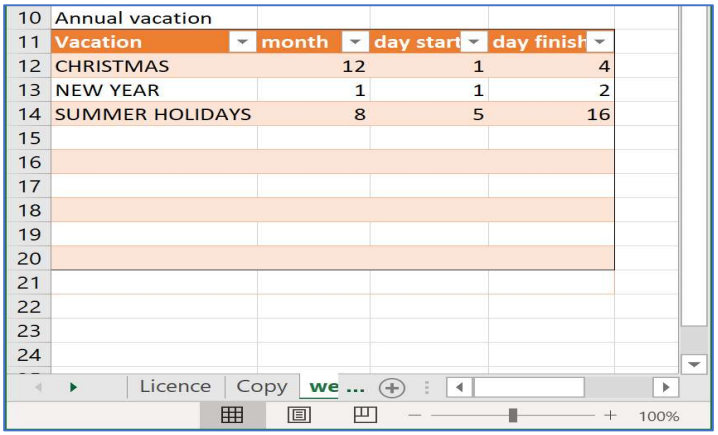


Figure 7 – Definition of the annual holiday pattern

Do note that the if a given holiday cross two month need to break down in each month portion.

At the moment is not embedded change of holiday start and finish dates for different years (e.g. Ramadan for Muslim countries, etc…)

At this point the user can initiate the first phase by clicking on "Update Work Day" command bottom from the Navigation menu (see Figure 3).

PHASE 2 – CALCULATIONS

First Step – Define the Control Activity

This step is the base of the analysis, and would be used for both the deterministic and Montecarlo analysis.

The tab to be used is the "**Data_input**".

The following set of parameters need to be entered:

- Key data by Work Breakdown Elements (WBE), including monetary amounts and dates, common for all analysis phases (from column A to G);
- Key data for the phase 3 resource analysis by categories (from column H to N);
- Key data for the phase 4 Montecarlo analysis (from column P to T);
- Key data for the phase 4 cost-time overrun correlaction factor (column V); and
- Key deterministic data from the previous budget (deterministic or P50/P80 values) that will be used for comparison purpose in phase 2 and 3 analysis (from column Y onwards).

First of all need to define the key tasks or Control Activities (CA) into the "**Data_input**" tab.

	A	B	C	D	E	F	G
1	New and Old Budget - Value>		USD	598.803.065,93	352.072.413,47		
2	wbe	Descriprion wbe	Description activity	Total amount USD	Amount to complete USD	New Start	New Finish
3	Bill No. 1.01.A	desxcription wbe 1	activity wbe1	62.854.693,99	22.464.182,45	1-gen-21	21-nov-21
4	Bill No. 1.02.B.B	desxcription wbe 2	activity wbe2	2.673.045,78	2.673.045,78	1-gen-21	21-mar-22
5	Bill No. 1.02.C.C	desxcription wbe 3	activity wbe3	544.959,13	544.959,13	1-gen-21	21-mag-22
6	Bill No. 1.02.D.D	desxcription wbe 4	activity wbe4	274.196,19	274.196,19	1-gen-21	21-nov-21
7	Bill No. 1.02.E.E	desxcription wbe 5	activity wbe5	2.437.329,70	2.437.329,70	1-giu-21	21-feb-22
8	Bill No. 1.02.F.F	desxcription wbe 6	activity wbe6	8.174.386,92	8.174.386,92	1-ott-21	21-feb-22
9	Bill No. 1.02.G.G	desxcription wbe 7	activity wbe7	6.349.514,99	6.349.514,99	1-ago-21	21-mag-22
10	Bill No. 1.02.H.H	desxcription wbe 8	activity wbe8	2.157.129,97	272.479,56	1-ago-21	21-gen-22
11	Bill No. 1.02.I.I	desxcription wbe 9	activity wbe9	23.992.261,58	23.992.261,58	1-gen-21	21-gen-22
12	Bill No. 1.02.J.J	desxcription wbe 10	ac	PHASE 2 - New shedule	326.975,48	1-gen-21	21-nov-21
13	Bill No. 1.03.K	desxcription wbe 11	activity wbe11	5.971.313,35	1.697.155,42	1-mar-21	21-giu-22
14	Bill No. 2.02.C.L	desxcription wbe 12	activity wbe12	92.685.018,84	1.815.509,87	1-feb-21	21-lug-21
15	Bill No. 2.02.E.A.M	desxcription wbe 13	activity wbe13	3.162.451,73	382.475,00	1-gen-21	21-gen-21
16	Bill No. 2.02.E.B.N	desxcription wbe 14	activity wbe14	175.138,15	175.138,15	1-gen-21	21-apr-21
17	Bill No. 2.02.E.C.O	desxcription wbe 15	activity wbe15	5.829.544,85	5.184.227,44	1-gen-21	21-mag-21
18	Bill No. 2.02.E.D.P	desxcription wbe 16	activity wbe16	5.139.607,71	4.228.259,11	1-gen-21	21-apr-21
19	Bill No. 2.02.E.E.A	desxcription wbe 17	activity wbe17	10.670.952,77	5.229.074,77	1-gen-21	21-giu-21
20	Bill No. 2.03.E.F.B	desxcription wbe 18	activity wbe18	7.904.472,29	4.116.978,25	1-gen-21	21-mag-21
21	Bill No. 2.03.E.G.C	desxcription wbe 19	activity wbe19	960.509,54	960.509,54	1-gen-21	21-giu-21
22	Bill No. 2.04.C.D	desxcription wbe 20	activity wbe20	152.151,23	152.151,23	1-feb-21	21-giu-21
23	Bill No. 2.04.E.E	desxcription wbe 21	activity wbe21	864.631,61	864.631,61	1-set-21	21-ott-21
24	Bill No. 2.04.E.F	desxcription wbe 22	activity wbe22	614.426,70	614.426,70	1-feb-21	21-mag-21
25	Bill No. 2.04.E.G	desxcription wbe 23	activity wbe23	10.404.652,32	10.404.652,32	1-mar-21	21-set-21

Licence | Data_Input | week_day_vacation | Copy | Schedule | Schedule_Amount | Sch

Figure 8 – Key Control Activities data to be entered.

The key data to be entered, for the Control Activities are:

- WBE (column A): relevant Work Breakdown Element (WBE);
- Description WBE (column B) – Description of the Work Breakdown Element;
- Description Activity(column C): description of the relevant CA. The user need to enter one CA for each row;
- Total Amount XXX (Column D): the monetary amount under analysis, in the chosen currency. The "XXX" would be picked up from the currency definition. This amount can be revenues or costs, depending from the type of analysis performed;
- Amount To Complete XXX (column E): the monetary amount to be spent to complete the Works. The "XXX" would be picked up from the currency definition;

- New Start (column F): the start date for the CA based on current deterministic definition; and
- New Finish (column G): the finish date for the CA based on current deterministic definition.

Second Step – Define the Category breakdown of the Monetary Amount (if required)

The tab to be used is the "**Data_input**".

At this point the user, if want, could define the Categories., that will be used within the Deterministic analysis.

The Categories are a further breakdown of the monetary amount into up to 6 elements.

Each Control Activities can have a separate break down up to 6 categories and the weightage for each category can be assigned at Control Activity level separately.

For each Control Activity the sum of the weightage need to sum up to 100%

For Example in the Demo Tool have been defined the following six categories:

La demo presenta le seguenti categorie:

1. Staff
2. Over Head (costi di struttura)
3. Manpower
4. Plant and Equipment
5. Material
6. Subcontract

If not required to define the categories, the column from H to M, where each of those are defined can be left blanks (heading and relative weightage).
Column N does contain an internal check if the sum of all contribution equal to 100&

H	I	J	K	L	M	N
Phase 3 - Evaluation resources : Percentage of distribution (to be insert)						
Staff	Other Over Head	Manpower	Plant and Equipment	Material	Subcontract	**Check**
80%	20%					100%
		40%	15%	45%		100%
		40%	15%	45%		100%
		40%	15%	45%		100%
		40%	15%	45%		100%
		40%	15%	45%		100%
		40%	15%	45%		100%
		40%	15%	45%		100%
		40%	15%	45%		100%
		40%	15%	45%		100%
PHASE 3 - Percentage of resouce for each activity						100%
						100%
						100%
		35%	20%	45%		100%
		40%	15%	45%		100%
		40%	15%	45%		100%
		40%	15%	45%		100%
		40%	15%	45%		100%
		40%	15%	45%		100%
		40%	15%	45%		100%
		35%	20%	45%		100%
		40%	15%	45%		100%
		40%	15%	45%		100%
		40%	15%	45%		100%

Figure 9 – Input mask for the Categories breakdown of the Control Activities

Third Step – Define Montercarlo Analysis Paramaters

The tab to be used is the "**Data_input**".

At this point the user is ready to enter the parameter, Control Activity by Control Activity that later on will drive the Montecarlo Analysis

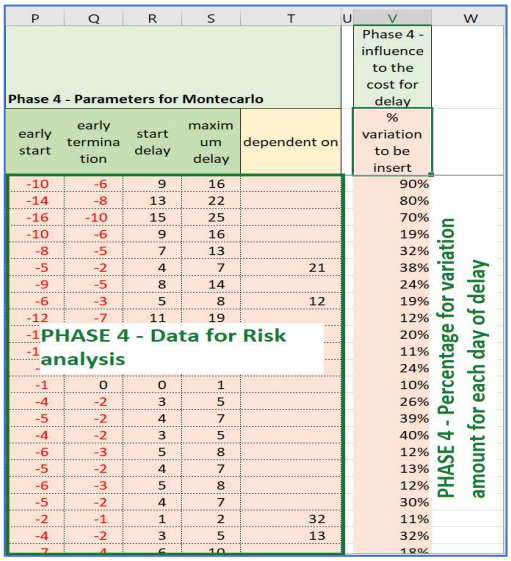


Figure 10 – Input mask for the Montecarlo Analysis

The user would need to enter in column/s:

- P and Q the early start and finish, respectively, slippage allowed;
- R and S the latest start and finish, respectively, slippage allowed;
- T the link between the various WBE; and
- V represent the extent that the monetary amount need to be adjusted considering delays to the control activity.For example let assume we do have a control activity with a duration of 10 days, if the user input a "% Variation" factor (column ET) of 45% a daily monetary amount of 10.000 euro would be increased of 45.000 euro (10.000 euro/day x 10 days x 45%) rather than 100.000 euro (10.000 euro /day x 10 days.

Fourth Step – Define the Previous analysis amounts

The tab to be used is the "**Data_input**".

At this point the user is ready to enter the parameter, Control Activity by Control Activity that later.

For each Control Activity from column X onward will be reported the previous analysis in monetary amount, if available and comparison with the current is later required.

Fifth Step – Run the Deterministic analysis

At this point the user can initiate the deterministic analyses by clicking on "Calculation" command bottom from the Navigation menu (see Figure 3).

PHASE 2 – RESULTS

At this point we can proceed with the next step of the deterministic analysis.

The user should open the "**Schedule_Am_Month**" tab.

The user will be prompt with the a table representing the distribution of the monetary amount, for each of the defined WBE (periodic value, if the time scale defined is month, it will be the monthly amount)
In this tab the user will be presented with the distribution on the time period defined, in this case month of the monetary amount.
The monetary amount considered in this analysis are the deterministic ones.

The user will be able to find the following further charts:

- In the "**Chart_Trend**" tab, the user can find the Cumulative Distribution Frequency of the aggregate deterministic monetary amount (sum of all the WBEs). In ordinate the user will found the monetary amount.
  With blue dots are drawn the point determined by the Tool, while in light grey the extrapolated ones (calculation made in "Trend Evaluation" tab, only for information).

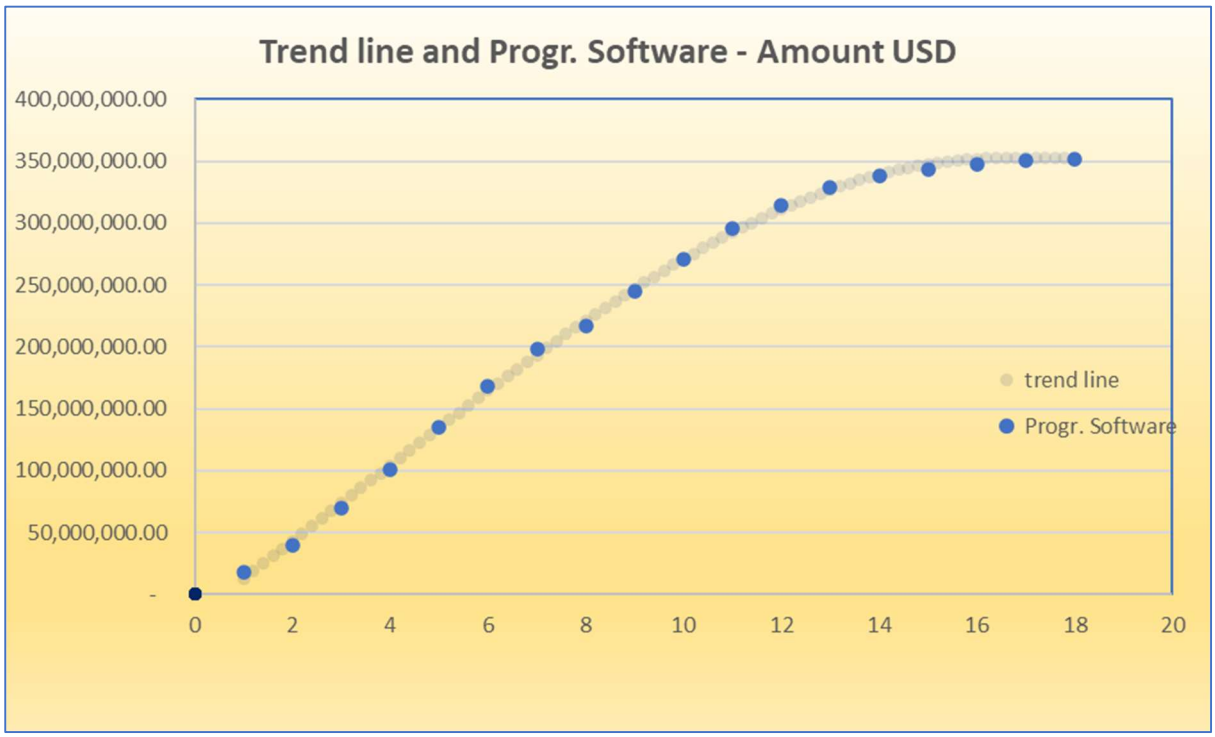


Figure 11 – Deterministic trend line

- In the tab "**Chart-Software**" the user can found the monthly distribution of the remaining monetary amount and the cumulative curve

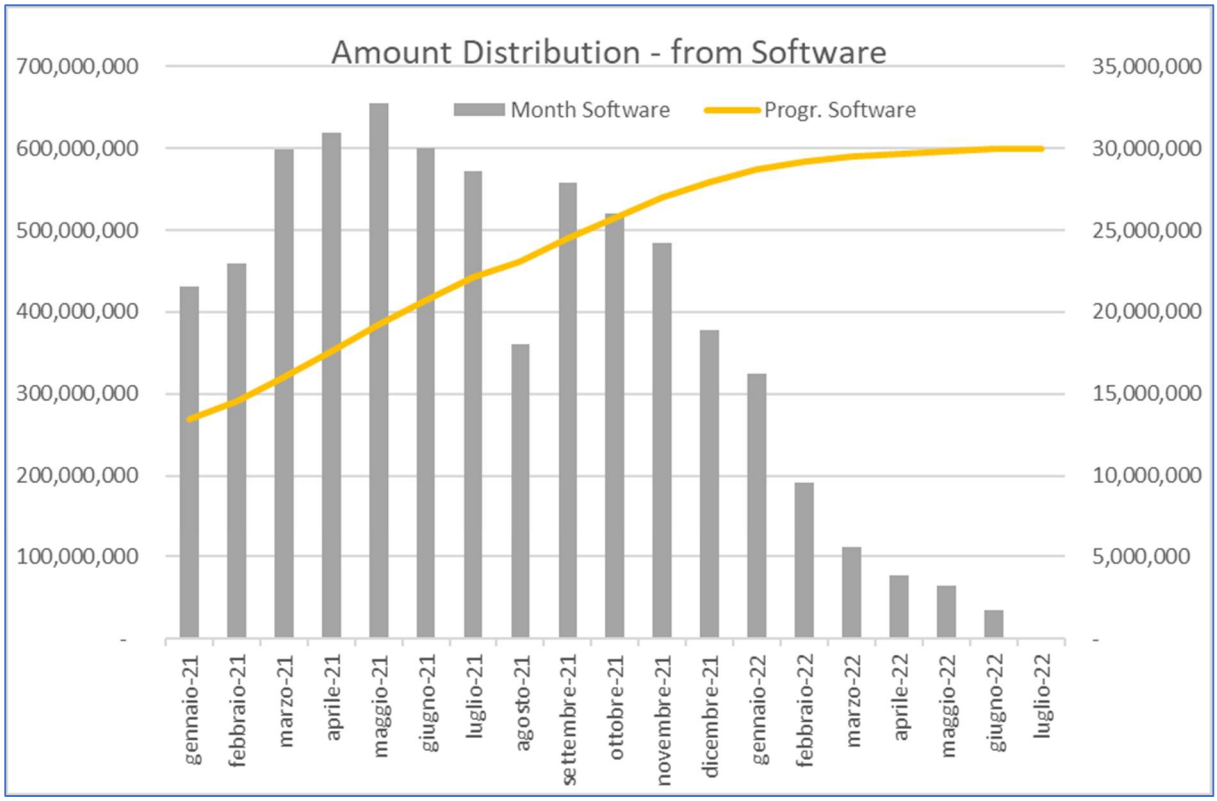


Figure 12 – Monetary amount distribution versus completion dates

- In the "***Chart-Previous-Software***" tab the user is presented with a comparison between the previous budget (if inserted) and the new calculated, either on monthly and cumulative basis.

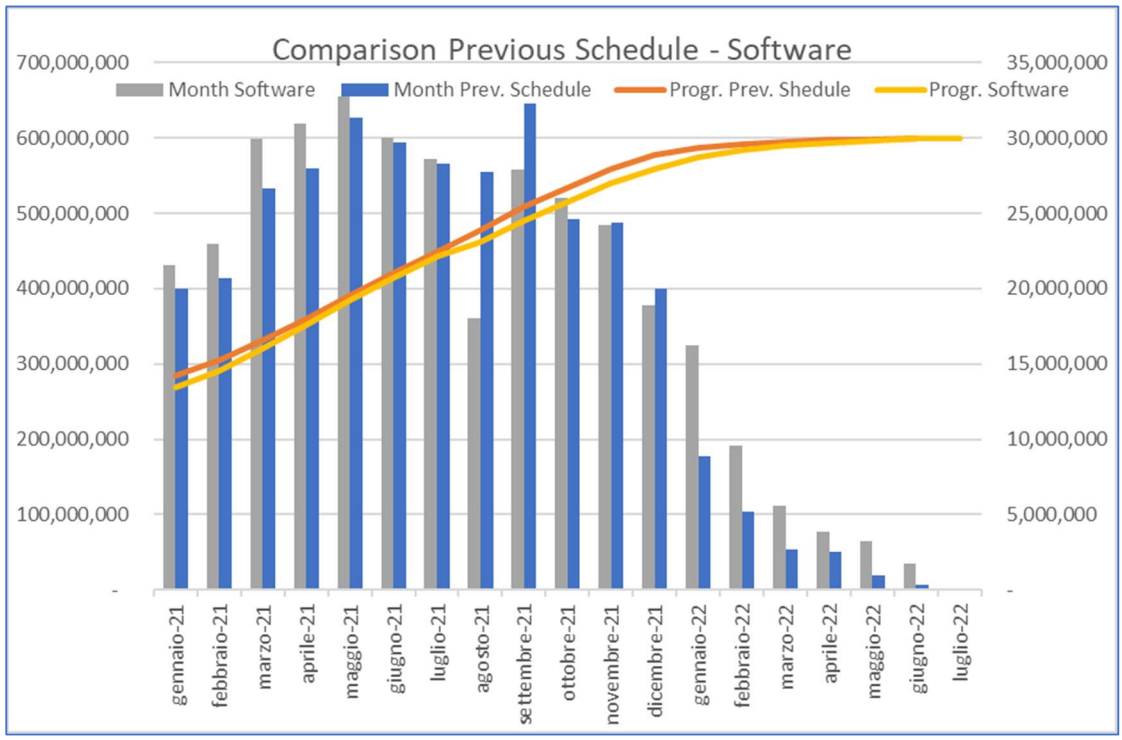


Figure 13 – Comparison of current deterministic monetary distribution against the previous.

PHASE 3 - RESOURCES

At this point the user can initiate the deterministic analyses by the Categories by clicking on "Resources" command bottom from the Navigation menu (see Figure 3).

At this point, if the user did enter the categories, it would be possible to further analyze the breakdown of the monetary amount into the various defined categories with the weights previously assigned.

This analysis, at detailed level WBE by WBE, can be found in the tabs "01" to "06", that within the Demo Tool were respectively Staff, Fixed costs of headquarters, Rental Equipment, Labor and Subcontracting.

If the user is instead interested in the summary analysis by the categories, this can be found in the "**Cash_Flow**" tab.

With this tab, with entering the payment terms and advance payment for the relevant categories, as may apply, if possible to defer in time the amounts, if the monetary amount is related to costs.

Further more populating the "inflation" at row 22 is possible to take in consideration increase in market costs (if the monetary amount is related to costs) in the analysis.

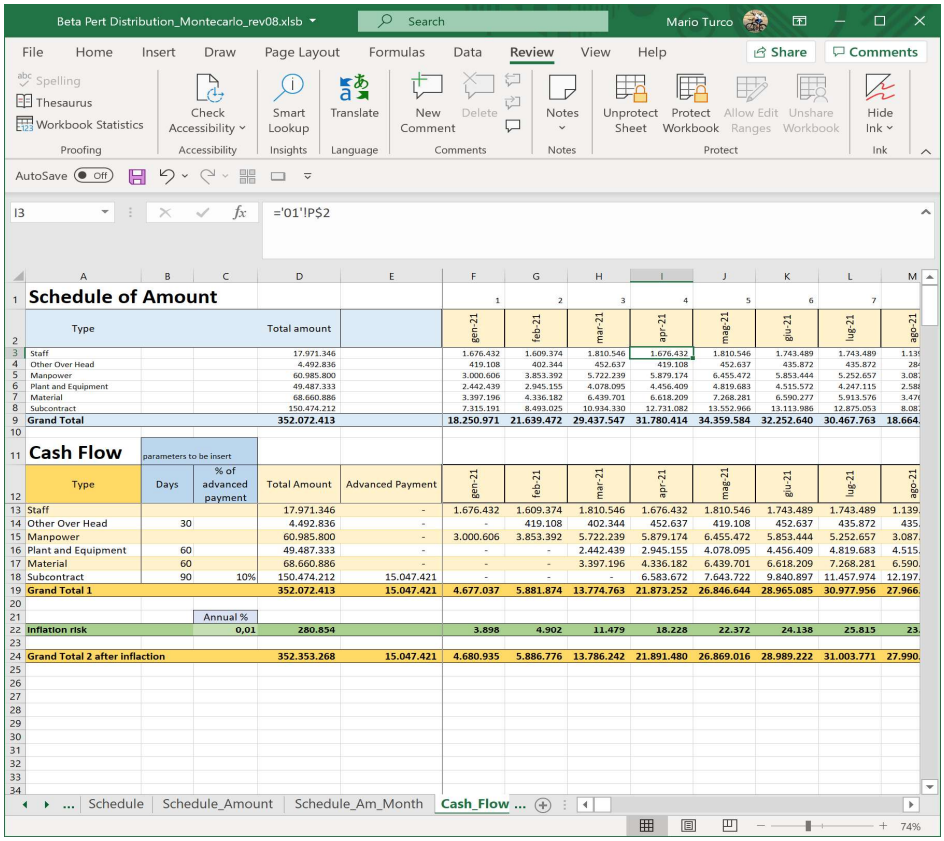


Figure 14 – Cash Flow & Inflation analysis

PHASE 4 – RISK ANALYSIS (MONTECARLO)

At this point the user can initiate the Montecarlo methodology application to the defined deterministic breakdown of the Works (WBE) based on the assigned deterministic monetary distribution and uncertainties parameters.

The Montecarlo analysis can start by clicking on "Risk Analysis (Montecarlo)" command bottom from the Navigation menu (see Figure 3).

The user in the tab "Pivot Montecarlo" can found the Montecarlo analysis summary, that derive from the detail calculation reported in "Montecarlo" tab.

In this tab for each of the simulation the system highlight correlate the computed completion date and relative monetary amount in order to determine their frequency and cumulative curve.

Delivery Day	frequency	cumulative	P50/P80	New Amount	delta
19/06/2022	2	2		354.276.420	2.204.006
20/06/2022	3	5		353.491.266	1.418.853
21/06/2022	7	12		353.559.871	1.487.458
22/06/2022	11	23		353.956.790	1.884.377
23/06/2022	21	44		353.715.870	1.643.456
24/06/2022	26	70		353.820.718	1.748.304
25/06/2022	31	101		353.954.060	1.881.647
26/06/2022	37	138		353.869.152	1.796.739
27/06/2022	32	170		353.917.860	1.845.446
28/06/2022	41	211		353.804.845	1.732.431
29/06/2022	33	244		353.916.615	1.844.202
30/06/2022	32	276		353.761.474	1.689.061
01/07/2022	27	303		353.858.036	1.785.623
02/07/2022	30	333		353.863.227	1.790.813
03/07/2022	37	370		353.770.736	1.698.322
04/07/2022	31	401		353.962.574	1.890.161
05/07/2022	35	436		353.768.880	1.696.466
06/07/2022	36	472		353.679.204	1.606.791
07/07/2022	37	509	509	353.721.134	1.648.721
08/07/2022	37	546		353.737.273	1.664.860
09/07/2022	30	576		353.855.963	1.783.550
10/07/2022	25	601		353.785.957	1.713.543
11/07/2022	29	630		353.759.914	1.687.500
12/07/2022	36	666		353.875.635	1.803.221
13/07/2022	30	696		353.757.400	1.684.987
14/07/2022	37	733		353.756.982	1.684.568
15/07/2022	21	754		354.099.987	2.027.573
16/07/2022	29	783		353.961.286	1.888.873

Figure 15 – Montecarlo analysis result summarised by frequency

The tool will also plot the distribution of time and cost with the cumulative curve and highlight the P50 and P80 points (most approximate point within the distribution)

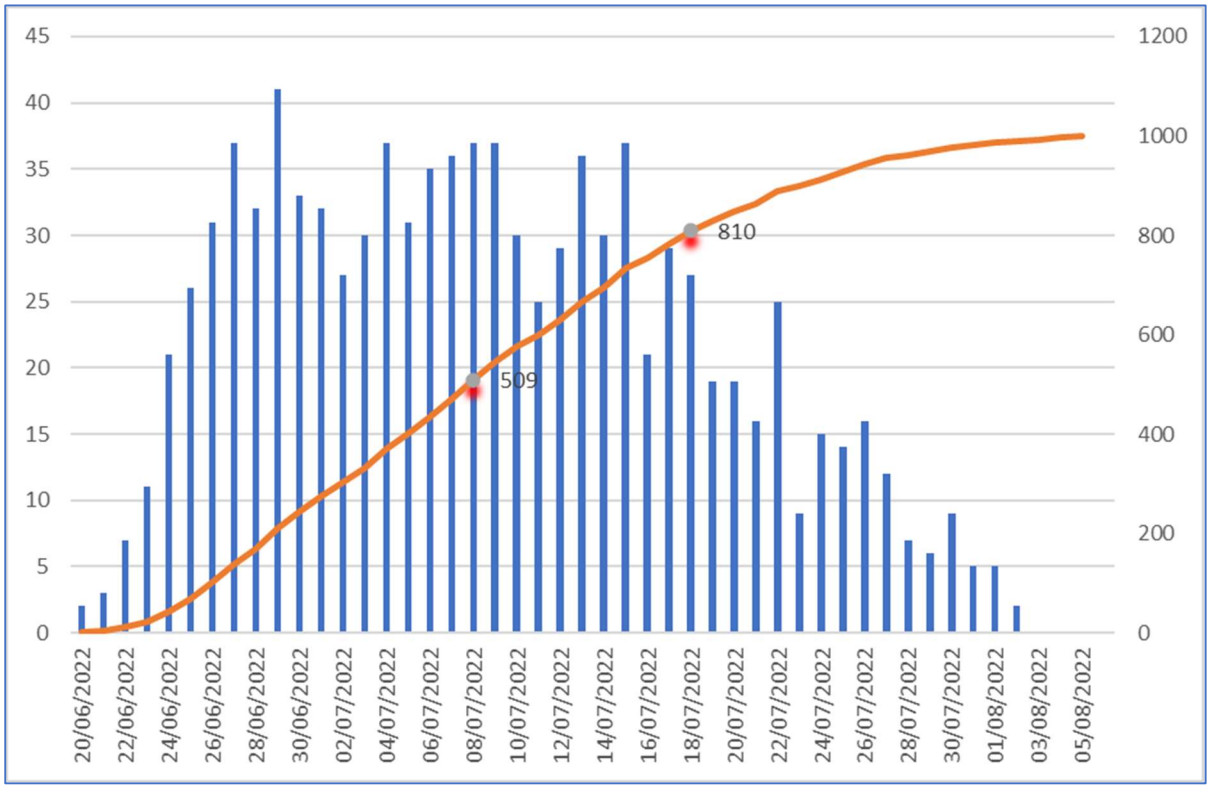


Figure 16 – Montecarlo distribution of monetary amount versus completion date and P50/P80 point determination

FINAL NOTES

Usability of the Analysis Data

Please be aware that all the analysis (tabs, charts) can be used in any other presentation or Excel file, after proper detachment from the source formulas (copy paste values for the formulas and copy picture for charts).

The user can also create any further charts of table based on the data, however the user should not change at any time, the existing tab naming, or the procedure will no work any more, as well adding or removing columns into the defined tabs.

Important Notice

The use of the software is permitted only to the user who has it in use.

It is not possible to insert columns or rows. If you have this need, remove the sheets and use them outside the program after having removed the protection.

It is not possible to change the name of the worksheets.