Information Assurance in Networked Enterprises: MICSS Lab Experiments, Results and Analysis

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A lab experiment has been performed using an ERP simulator to study the impact of information failure on the results of a company. Two scenarios have been considered: correct but delayed information, and wrong information. The influence of the length of delay, of the error size, and of the dataset concerned by the failure have also been studied.
It follows from the analysis that: - The consequences of a given information failure depend on the dataset in which the
failure occurs. - For a given dataset, information failures impact depends on the failure type.
- The influence of the length of delay depends on the dataset.
- The influence of the error size depends on the dataset

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MICSS Lab Experiments, Results and Analysis

Thomas Bellocci, Parbati Ray and Shimon Y. Nof

ABSTRACT

A lab experiment has been performed using an ERP simulator to study the impact of information failure on the results of a company. Two scenarios have been considered: correct but delayed information, and wrong information. The influence of the length of delay, of the error size, and of the dataset concerned by the failure have also been studied.
It follows from the analysis that:

- The consequences of a given information failure depend on the dataset in which the failure occurs.
- For a given dataset, information failures impact depends on the failure type.
- The influence of the length of delay depends on the dataset.
- The influence of the error size depends on the dataset.

So far companies employ local, specialized solutions that are too restrictive, or not comprehensive. The experiments presented in this paper justify economically the use of solutions with variable assurance in ERP systems. They also provide directions for the design of autonomous agents systems to handle these assurance problems.

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1. **Problem Introduction:**

1.1. Purpose of the experiment:

As a step in refining the assurance requirements survey and showing the variable needs in information assurance, experiments have been conducted with an ERP software simulator-trainer called MICSS (Management Interactive Case Study Simulator) [16]. MICSS was developed to simulate the functioning of a company with a team-oriented view.

In our previous research [1], it has been discovered that we can encounter 3 scenarios regarding information in an ERP system. A data item can indeed be correct, correct but delayed, or wrong.
So, we have decided to carry out a set of experiments to study the potential consequences of information failures on the results of a company.

1.2. Previous research:

A class experiment involving the undergraduate students of course IE332 has been done earlier. This has provided us with a large amount of data that has been analyzed [17]. The measures were not fully reliable to carry out a deep statistical analysis. Nevertheless, it has shown interesting trends that have encouraged us in organizing our own experiment, where we could master all the parameters.

1.3. Hypotheses:

The hypothesis of our team experiment was that the performance of a company would significantly different in the case of delayed and wrong information than in the case of correct information.

H_0 = The performance achieved by a company with a baseline policy is similar to the performance achieved by the same company when information failures (delayed or wrong information) occur in the baseline policy.

H_1 = The performance achieved by a company with a baseline policy is significantly different to the performance achieved by the same company when information failures (delayed or wrong information) occur in the baseline policy.

$\alpha = 0.05$ (a 95% confidence interval to prove the hypothesis.)

if p val ≤ 0.05,we can conclude with 95% confidence that we reject the null hypothesis H_0

To verify the above hypothesis, the data was analyzed using single factor ANOVA, an analysis tool in EXCEL.

2. **Method:**

2.1. Equipment:

MICSS (Management Interactive Case Study Simulator) [16] is an ERP simulator that has been developed to simulate the functioning of a company with a team-oriented view.

MICSS has four views of a company, namely Marketing, Production, Purchasing and Finance. Each of these views has certain policies, which combine in an optimal way in order to be profitable for the company. However often the four departments of the company are unable to communicate properly and this creates discrepancies in the policies developed and hence, in information assurance.

MICCS enables us to simulate the functioning of a company through one year.

2.2. Design of experiment:

We have decided to study 4 factors in this experiment.

Factor 1:
Dataset; with 4 levels: Prices, QLT, Batch Size, and Order Levels.
Factor 2:
Failure type; with 2 levels: "wrong information", and "delayed information"
Factor 3 (nested in "wrong information"):
Error size; with 2 levels "value doubled", and "value halved".
Factor 4 (nested in "delayed information"):
Length of delay; with 2 levels "4 months", and "8 months".

So, we finally had 17 scenarios to simulate:

<u>List of all the scenarios:</u>

-*Correct information:*
(1) Baseline policy

-*Wrong information:*
(2) QLT doubled
(3) Prices doubled
(4) Batch Size doubled
(5) Order Level doubled
(6) QLT divided by 2
(7) Prices divided by 2
(8) Batch Size divided by 2
(9) Order Level divided by 2

- *Delayed information:*

(10) QLT delayed 4 months
(11) Prices delayed 4 months
(12) Batch Size delayed 4 months
(13) Order Level delayed 4 months
(14) QLT delayed 8 months
(15) Prices delayed 8 months
(16) Batch Size delayed 8 months
(17) Order Level delayed 8 months

2.3. Metrics:

To assess the performance of the company, we have decided to record the Profit and the Due Date Performance (DDP). These data have been chosen as the profit represents how the whole company is performing, and the DDP gives an idea of how well the company is organized.

2.4. Experimentation Procedures:

Wrong information scenarios
A dataset of the baseline policy is modified (doubled or halved) and MICSS is run for 2 months. Then the data is corrected and MICSS is run by periods of 2 months to reach the end of the year.
10 runs of one year are performed for each scenario.

Delayed information scenarios
A dataset of the baseline policy is modified (data-25%, because it is a realistic value that can be encountered in the functioning of the company). Then MICSS is run for 4 or 8 months, by periods of 2 months, depending on the length of the delay we are simulating. Then the data is corrected (i.e. the normal value of the dataset in the baseline policy is released) and MICSS is run by periods of 2 months to reach the end of the year.
10 runs of one year are performed for each scenario.

3. Results:

The observations haven't been analyzed like a nested design. We didn't need all the information given by a nested design analysis. For simplicity and time saving, we have used single ANOVAs to compare each time two different scenarios.

For each dataset, the following comparisons are presented in Appendix:
Dataset delayed 4 months / Baseline policy (for profit and DDP).
Dataset delayed 8 months / Baseline policy (for profit and DDP).

Dataset wrong half / Baseline policy (for profit and DDP).
Dataset wrong double / Baseline policy (for profit and DDP).

The datasets are presented in this order: Prices, QLT, Batch Size, Order Level.

Then, the influence of the length of the time delay and of the difference between the wrong and correct data are presented.

<u>Summary:</u>

<u>Notations:</u>
“D” means: The two scenarios give significantly different results.
“D -“ means that the performance with information failure, for profit or DDP, is worse than with the baseline policy.

"D +" means that the performance with information failure, for profit or DDP, is better than with the baseline policy.
"S" means: The two scenarios give significantly similar results.

Table 1 summarizes for each dataset:

- Which information failure scenario has the largest impact on the functioning of the company ("1" means greatest impact).
- Which metrics is the most affected by a failure in each dataset.
- Whether or not the length of delay has an influence on the results.
- Whether or not the error size has an influence on the results.

A complete analysis and graphical representation of these results can be found in Appendix.

Table 1 - Summary of the team experiment results.

Dataset Level	Prices	QLT	Batch Size	Order
Impact ranking	1. Wrong double 2. Wrong half 3. Delayed 8 months 4. Delayed 4 months	1. Wrong double 2. Wrong half 3. Delayed 8 months 4. Delayed 4 months	1. Wrong half Then similar for: Wrong double Delayed 8 months Delayed 4 months	Similar for all the scenarios
Metrics sensitivity	1. Profit 2. DDP	Similar for profit and DDP	1. DDP 2. Profit	Similar for profit and DDP
Length of delay	Important	Not important	Not important	Not important
Error size	Important	Important	Important	Not important

4. Conclusions and Discussion:

4.1. Impact graphs:

Impact graphs summarize the impact of each information failure type by dataset (Fig. 1.a and 1.b). The relative differences:

a. (Profit with information failure - Profit with baseline policy) / (Profit with baseline policy)
b. and: (DDP with information failure - DDP with baseline policy) / (DDP with baseline policy)

are represented respectively in Fig. 1.a and 1.b.
These differences are shown using levels: [> 70%; 35 to 70%; 5 to 35%; +/- 5%; -5 to -35%; -35 to -70%; < -70%]

The following notations are used in Fig. 1.a and 1.b:

D4: scenario with information delayed 4 months
D8: scenario with information delayed 8 months
Wh: scenario with information wrong half
Wd: scenario with information wrong double

4.2. Conclusions:

1/ Some datasets are more sensitive than others. For example the consequences of a problem concerning Prices is much more serious and long lasting than when it concerns QLT. We can rank the datasets that have been tested by decreasing sensitivity: Prices, QLT, Batch Size, Order Level.
2/ Datasets have different characteristics that make them more sensitive to a specific type of information failure. For example, a delay of 8 months has a large impact on Profit when it concerns Prices, but no real impact when it concerns QLT.
3/ Profit is very sensitive to information failures. DDP react more slowly and need long lasting and large errors to be modified.

4/ The importance of information failure has been proved.
5/ The importance of the length of delay, and of the error size has been proved.
6/ We have seen that different scenarios can have very different consequences. A targeted security solution can then be designed to prevent the most serious cases first.

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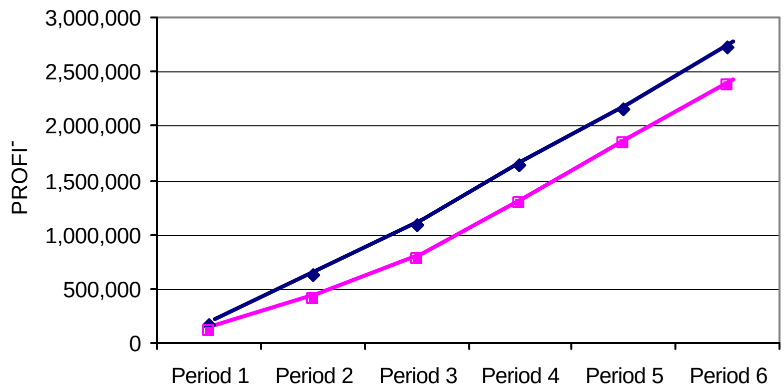
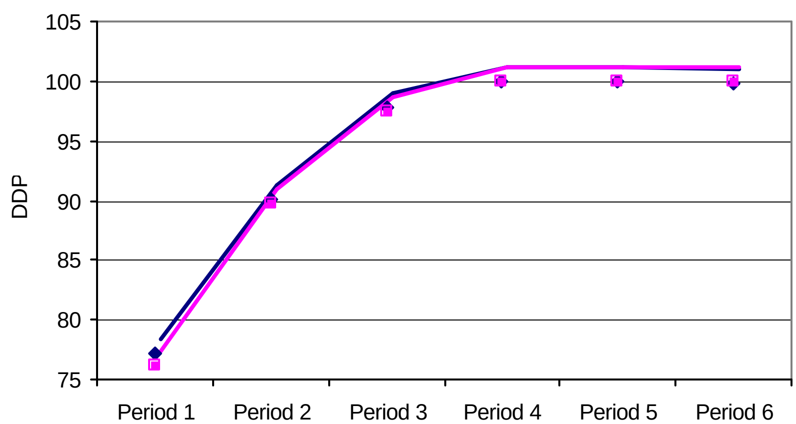
APPENDIX

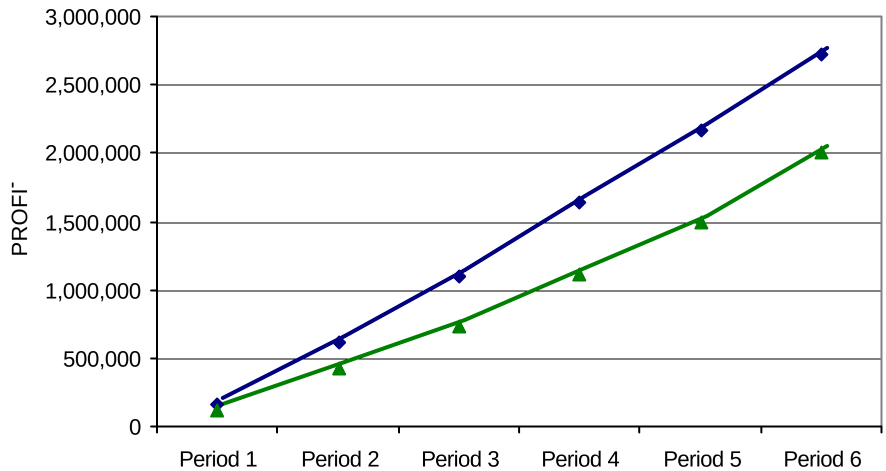
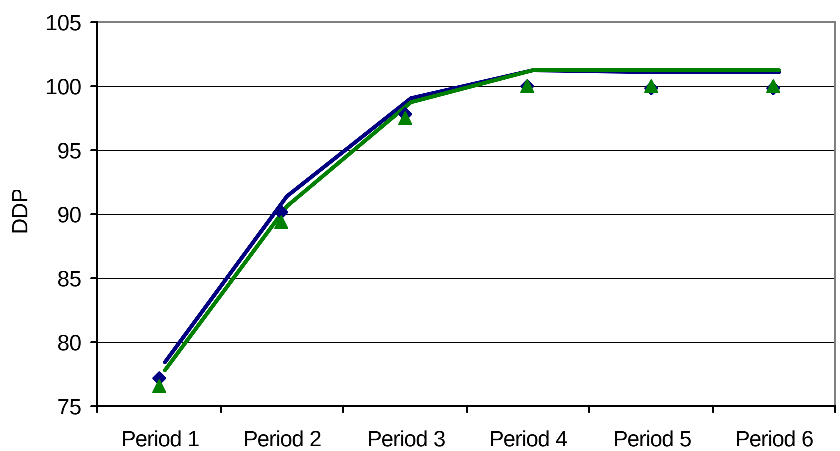
Fig.A1 - Prices; Dataset delayed 4 months / Baseline policy (for profit *and DDP).*

	Baseline policy (10 runs)					
Prices Delayed 4 months (10 runs) Metric: Profit						
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	D -	D -	D -	D -	D -	D -
						
	Metric: DDP					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	D -	S	S	S	S	S
						

<u>Observations:</u>

- For profit: during the 4 months of delay, the performance is worse. Then when the information is corrected (return to the baseline policy) the company follows the same evolution than with the correct scenario, but the gap due to the delay cannot be filled.
- For DDP: There are slight consequences that can be easily filled when the information is corrected.

Fig.A2 - Prices; Dataset delayed 8 months / Baseline policy (for profit and DDP).

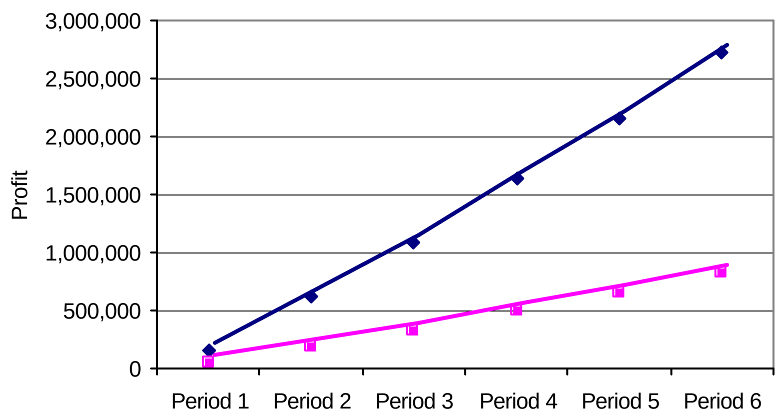
	Baseline policy (10 runs)					
Prices Delayed 8 months (10 runs) Metric: Profit						
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	D -	D -	D -	D -	D -	D -
						
	Metric: DDP					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	S	S	S	S	S	S
						

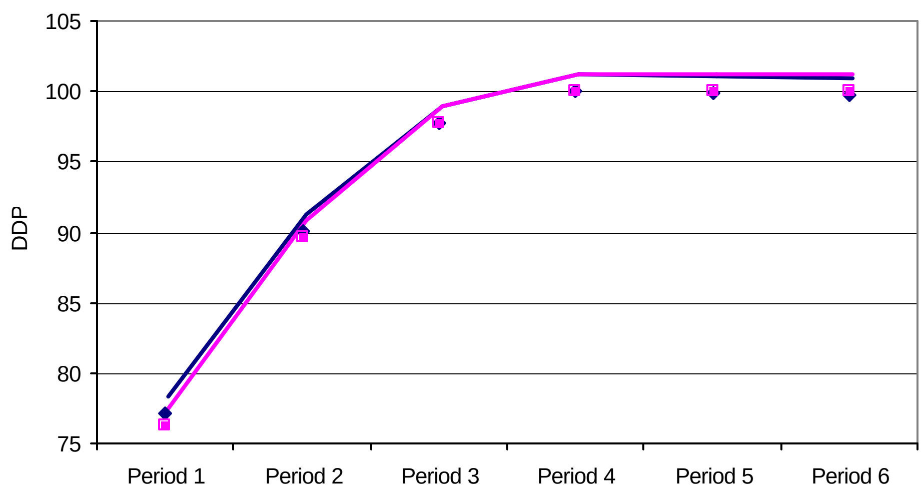
Observations:

- For profit: during the 8 months of delay, the performance is worse. Then when the information is corrected (return to the baseline policy) the company follows the same evolution than with the correct scenario, but the gap due to the delay cannot be filled.

- For DDP: There are slight consequences that can be easily filled when the information is corrected.

Fig.A3 - Prices; Dataset wrong half / Baseline policy (for profit and DDP).

	Baseline policy (10 runs)					
Prices Wrong half (10 runs)	Metric: Profit					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	D -	D -	D -	D -	D -	D -
						
	Metric: DDP					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	S	S	S	S	S	S



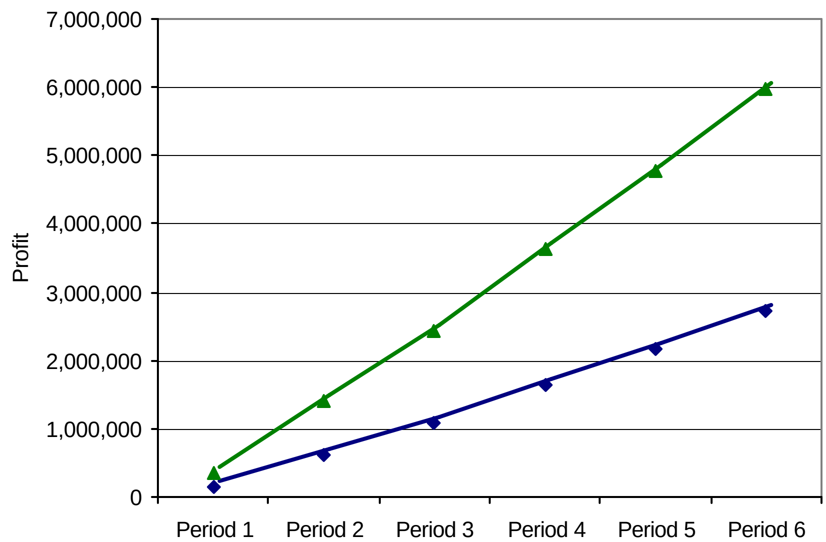
<u>Observations:</u>

- For profit: The information is wrong only during the first 2 months. But when the information is corrected (return to the baseline policy) the company doesn't follow the same evolution than with the correct scenario. In this case, wrong information has long-lasting consequences.

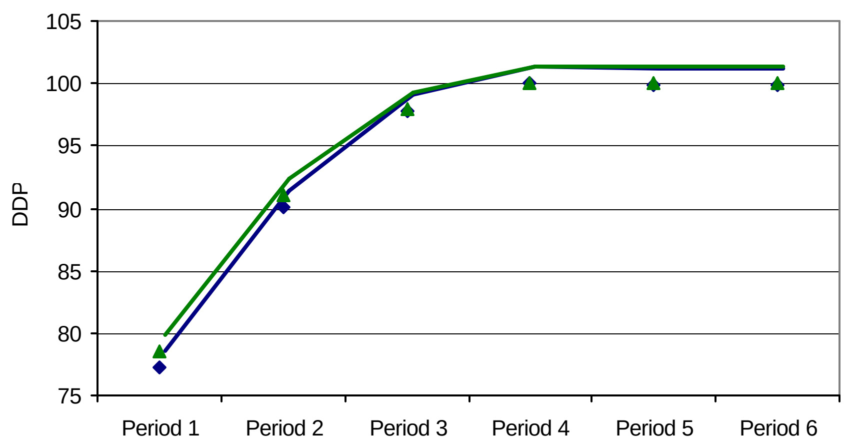
- For DDP: There are not major consequences.

Fig.A4 - Prices; Dataset wrong double / Baseline policy (for profit and DDP).

	Baseline policy (10 runs)					
Prices Wrong double (10 runs)	Metric: Profit					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	D +	D +	D +	D +	D +	D +



	Metric: DDP					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	S	S	S	S	S	S

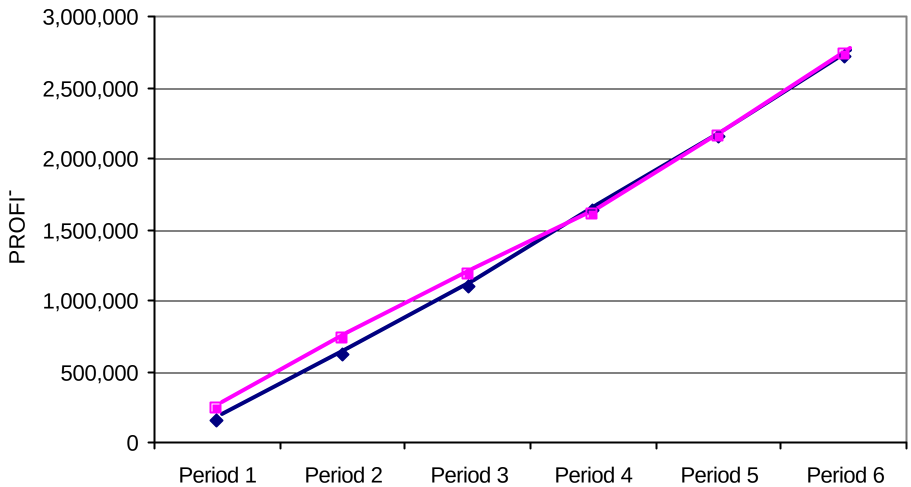


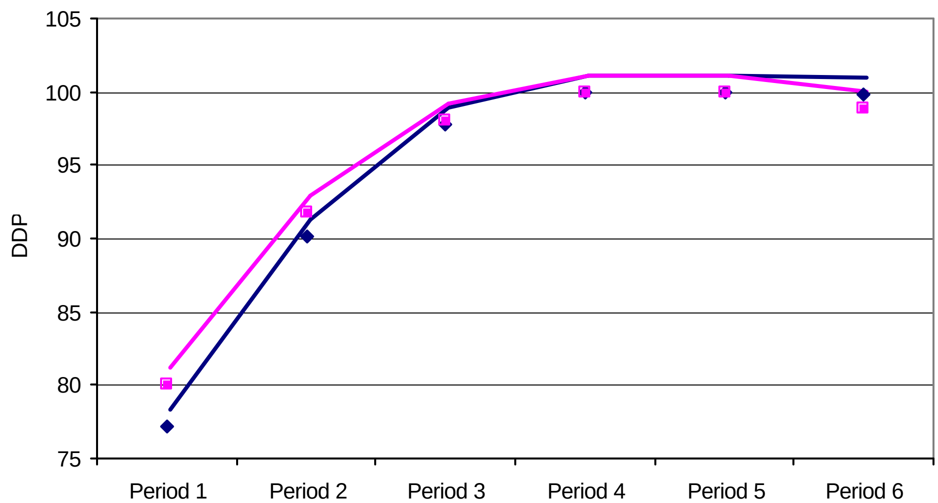
Observations:

- For profit: The information is wrong only during the first 2 months. But when the information is corrected (return to the baseline policy) the company doesn't follow the same evolution than with the correct scenario. In this case, wrong information has long-lasting consequences.

- For DDP: There are not major consequences.

Fig.A5 - QLT; Dataset delayed 4 months / Baseline policy (for profit and DDP).

	Baseline policy (10 runs)					
QLT Delayed 4 months (10 runs) Metric: Profit						
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	D +	D +	S	S	S	S
						
	Metric: DDP					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	D +	D +	S	S	S	S



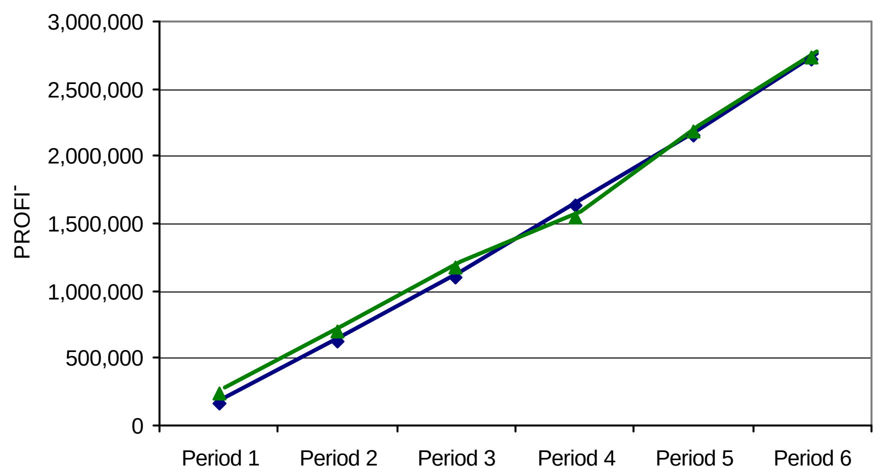
Observations:

- For profit: Consequences last 2 months after the return to the baseline policy. Then the company follows the same evolution than with correct information without any gap.

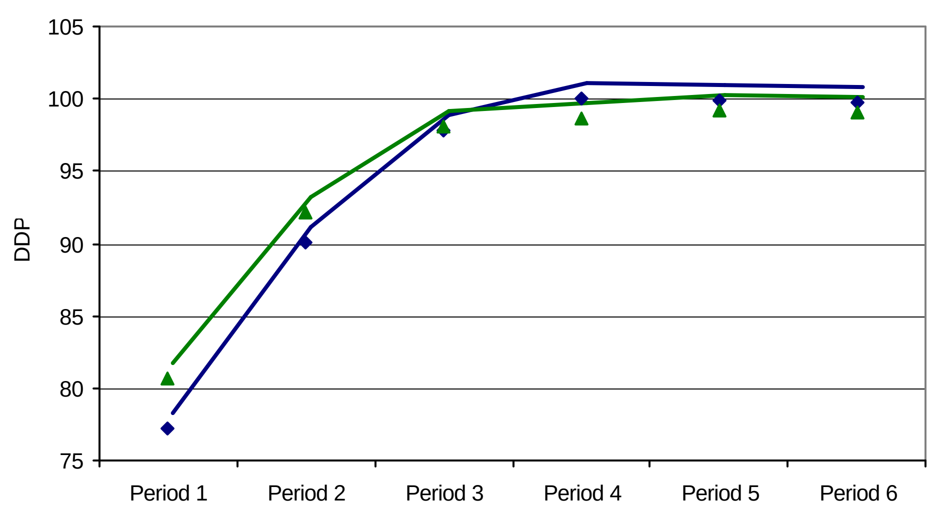
- For DDP: There are major consequences during the 4 months of delayed information. But the company recovers as soon as the information is corrected.

Fig.A6 - QLT; Dataset delayed 8 months / Baseline policy (for profit and DDP).

	Baseline policy (10 runs)					
QLT Delayed 8 months (10 runs)	Metric: Profit					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	D +	D +	D +	S	S	S



	Metric: DDP					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	D +	D +	S	S	S	S



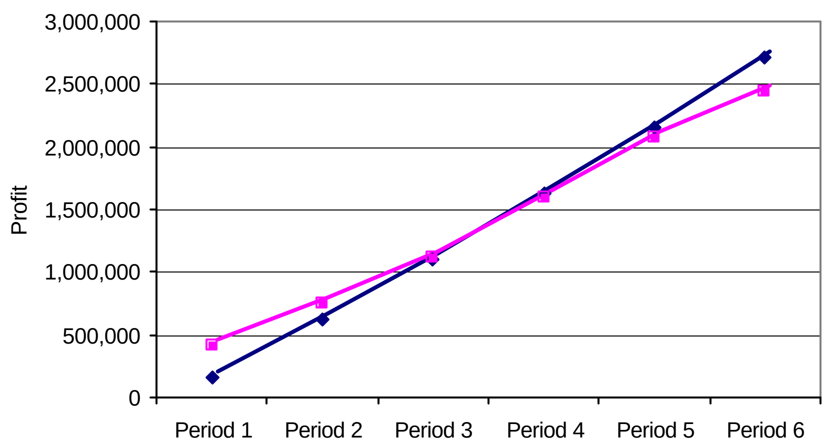
<u>Observations:</u>

- For profit: The performance of the company is affected during the 8 months of delayed information. Then, after returning to the baseline policy, the company follows the same evolution than with correct information without any gap.
- For DDP: There are major consequences during the first 4 months of delayed

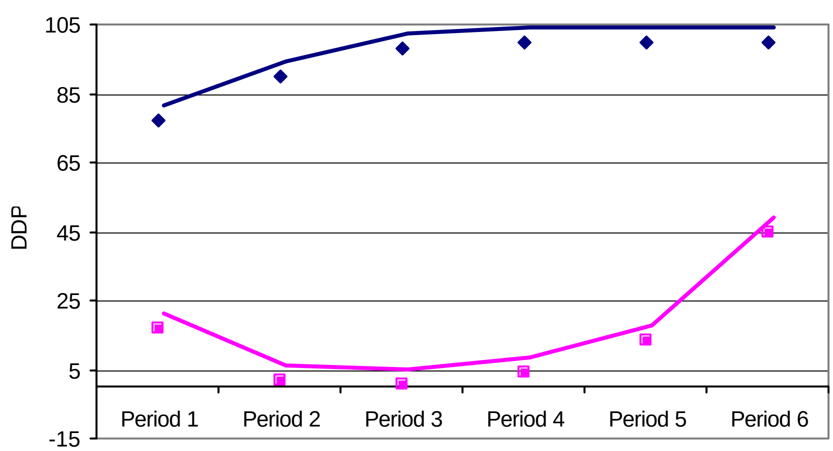
information. Then the performance is not significantly different from the baseline scenario even if it looks slightly worst.

Fig.A7 - QLT; Dataset wrong half / Baseline policy (for profit and DDP).

	Baseline policy (10 runs)					
QLT Wrong half (10 runs)	Metric: Profit					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	D +	D +	S	S	S	D -



	Metric: DDP					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	D -	D -	D -	D -	D -	D -

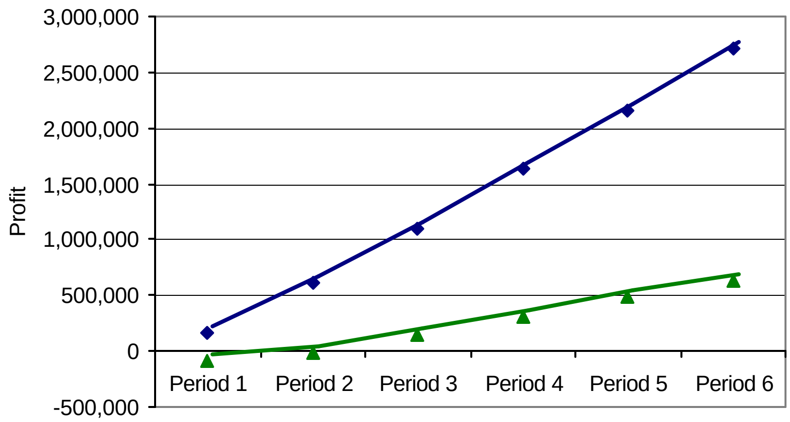


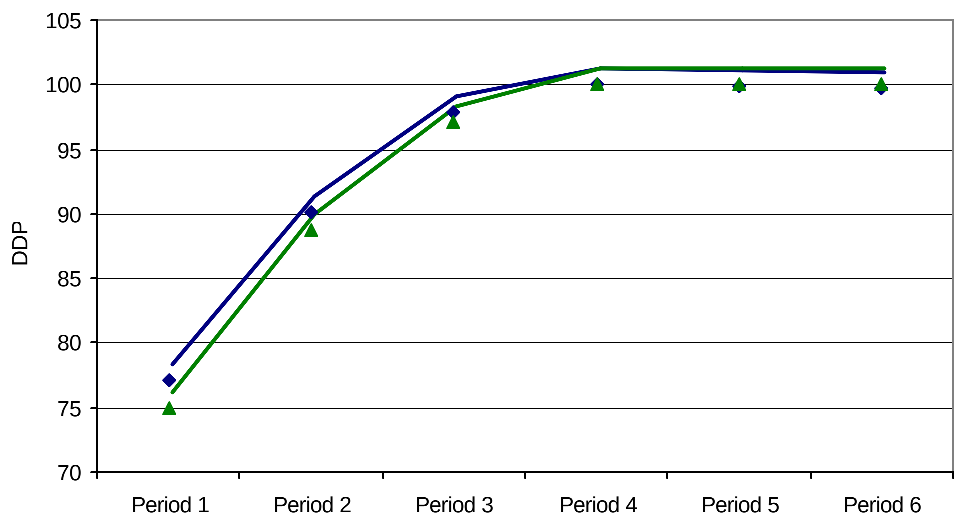
<u>Observations:</u>

- For profit: After returning to the baseline policy, the company doesn't follow the same evolution than with correct information. The slope is smaller. There are long-lasting consequences.
- For DDP: There are major consequences that are long lasting. At the beginning the company receives a lot of orders as it provides products at the same price but with a QLT half of the baseline policy. Therefore the DDP decreases as the company cannot

satisfy all the orders on time. So the amount of orders decreases and the DDP increases. This explains why the profit is finally smaller in period 6.

Fig.A8 - QLT; Dataset wrong double / Baseline policy (for profit and DDP).

	Baseline policy (10 runs)					
QLT Wrong double (10 runs)	Metric: Profit					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	D -	D -	D -	D -	D -	D -
						
	Metric: DDP					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	D -	D -	D -	S	S	S

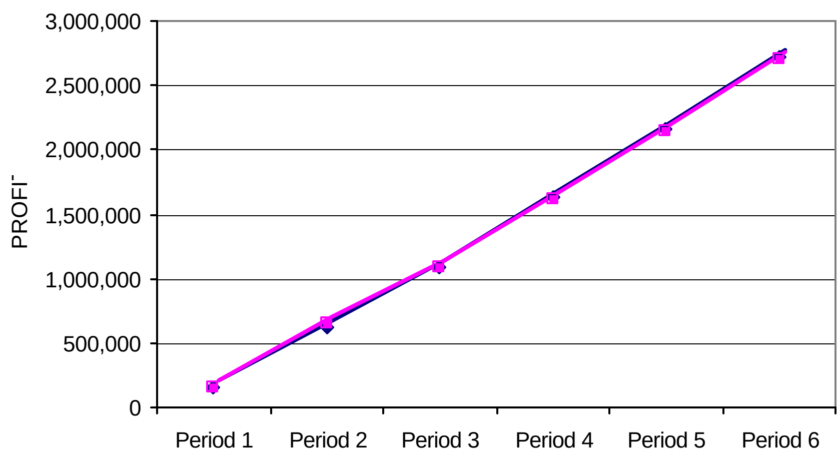
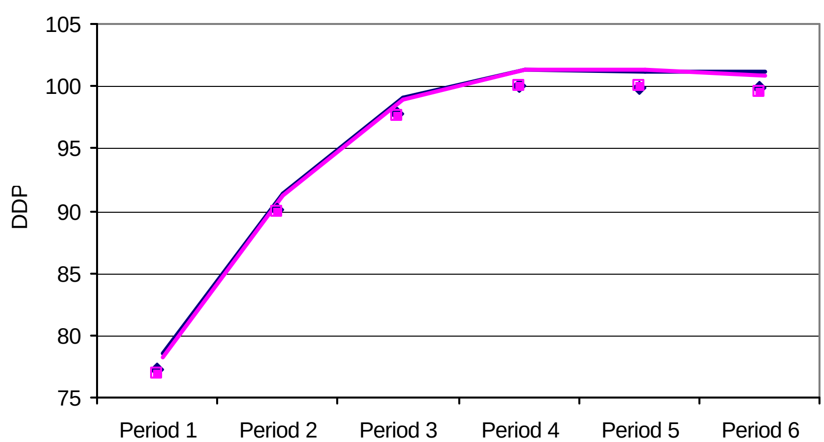


<u>Observations:</u>

- For profit: After returning to the baseline policy, the company doesn't follow the same evolution than with correct information. The slope is smaller. There are long-lasting consequences.

- For DDP: There are major consequences that last even after returning to the baseline policy. But finally the gap is filled.

Fig.A9 - Batch Size; Dataset delayed 4 months / Baseline policy (for profit and DDP).

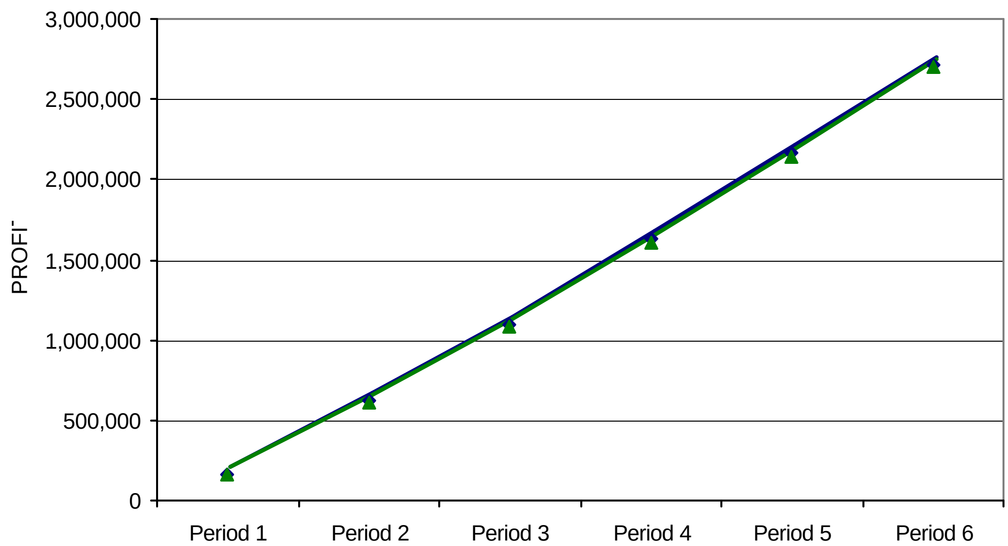
	Baseline policy (10 runs)					
Size of Batch Delayed 4 months (10 runs) Metric: Profit						
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	S	S	S	S	S	S
						
	Metric: DDP					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	S	S	S	S	S	S
						

<u>Observations:</u>

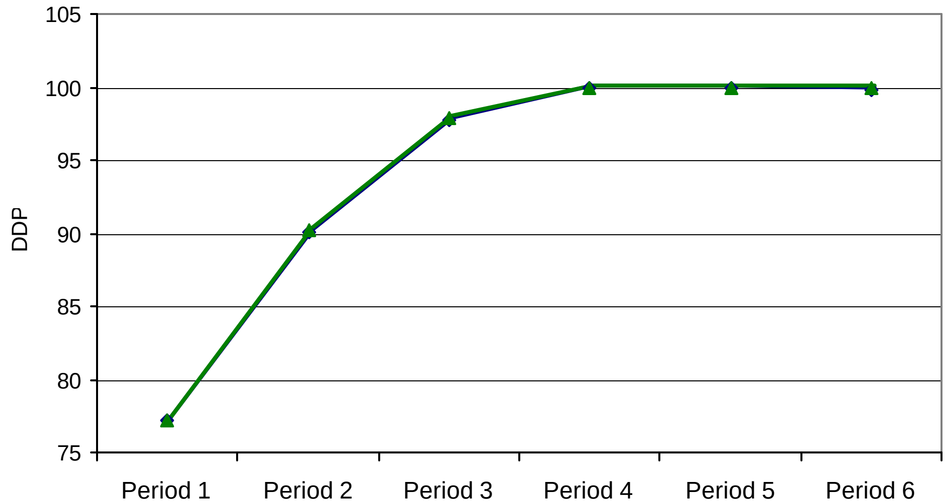
- For profit: There are no consequences of delayed information.
- For DDP: There are no consequences of delayed information.

Fig.A10 - Batch Size; Dataset delayed 8 months / Baseline policy (for profit and DDP).

	Baseline policy (10 runs)					
Size of Batch Delayed 8 months (10 runs) Metric: Profit						
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	S	S	S	S	S	S



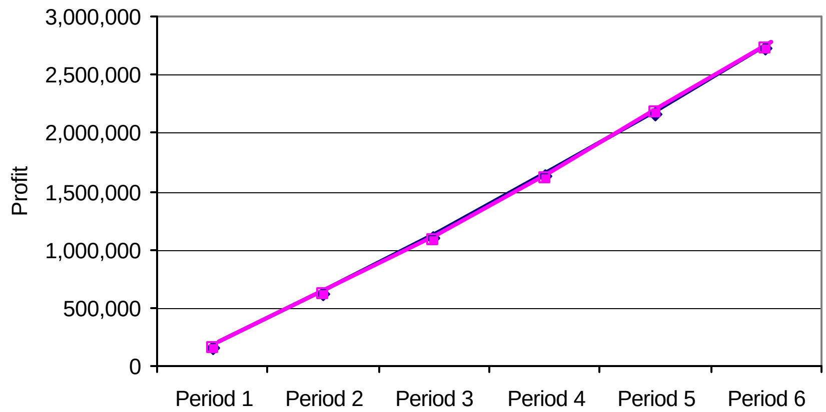
	Metric: DDP					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	S	S	S	S	S	S

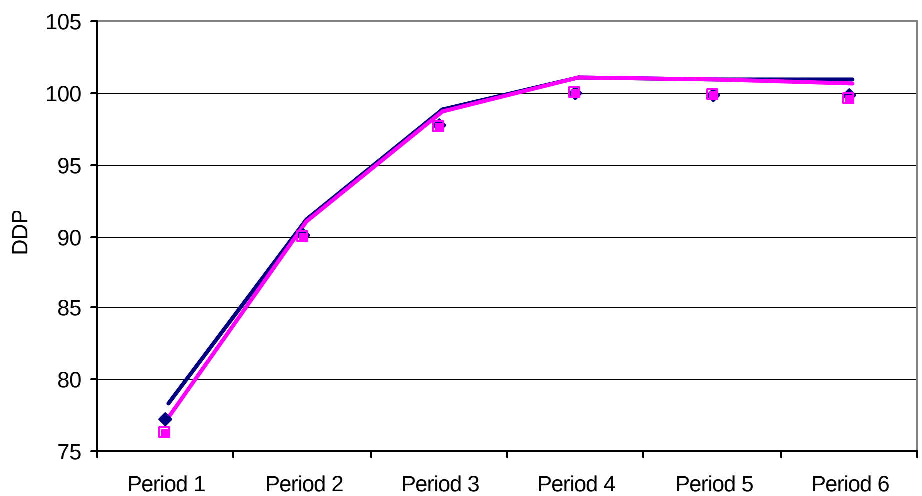


<u>Observations:</u>

- For profit: There are no consequences of delayed information.
- For DDP: There are no consequences of delayed information.

Fig.A11 - Batch Size; Dataset wrong half / Baseline policy (for profit and DDP).

	Baseline policy (10 runs)					
Size of Batch Wrong half (10 runs)	Metric: Profit					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	S	S	S	S	S	S
						
	Metric: DDP					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	S	S	S	S	S	S

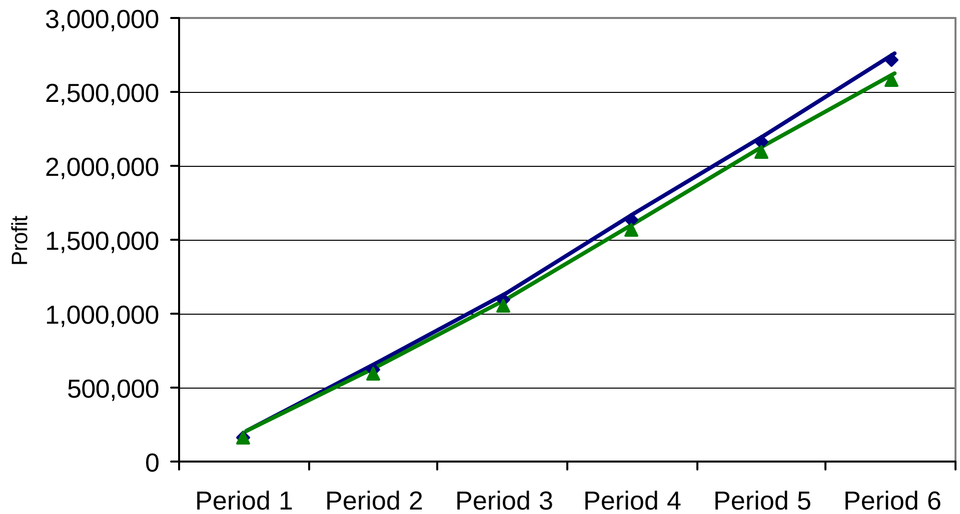


Observations:

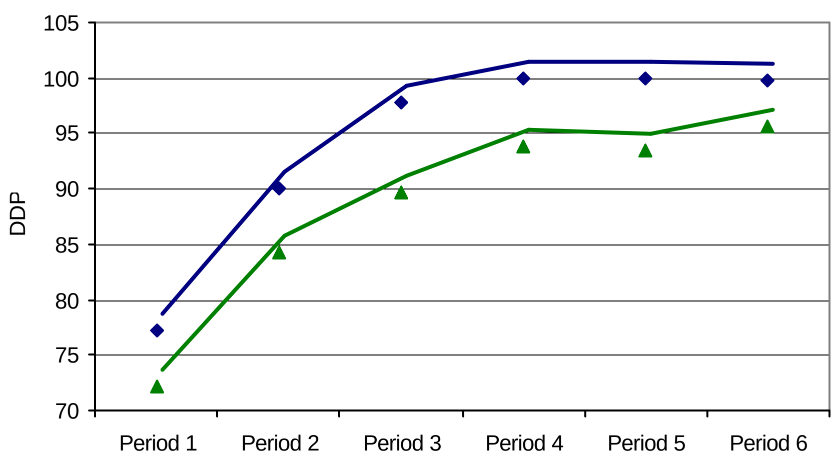
- For profit: There are no consequences of wrong information.
- For DDP: There are no consequences of wrong information.

Fig.A12 - Batch Size; Dataset wrong double / Baseline policy (for profit and DDP).

	Baseline policy (10 runs)					
Size of Batch Wrong double (10 runs)			Metric: Profit			
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	S	S	S	S	S	D -



	Metric: DDP					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	D -	D -	D -	D -	D -	D -

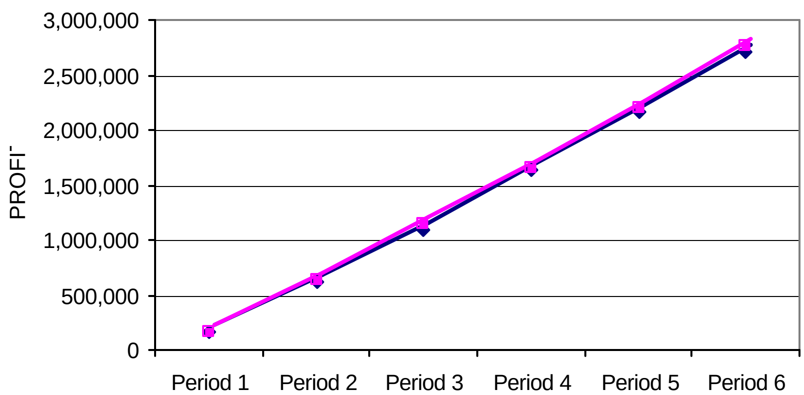
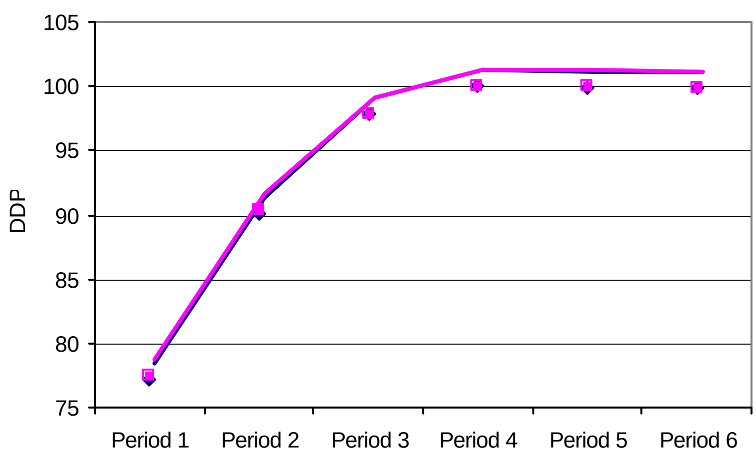


<u>Observations:</u>

- For profit: There are no consequences of the wrong information that occurred during the first 2 months, but they appear only at the end of the year in period 6. This is certainly due to the behavior of the DDP.

- For DDP: There are major consequences of wrong information. It evolves in parallel with the baseline scenario, and it never reaches the same level of performance. The consequence of this low DDP is a smaller profit in period 6.

Fig.A13 - Order Level; Dataset delayed 4 months / Baseline policy (for profit and DDP).

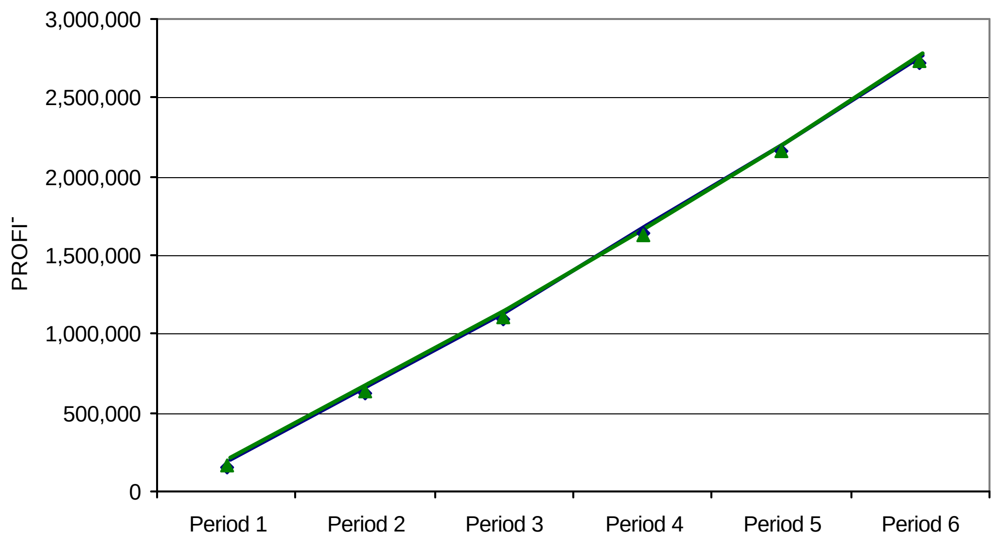
	Baseline policy (10 runs)					
Order Levels Delayed 4 months (10 runs) Metric: Profit						
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	S	S	S	S	S	S
						
	Metric: DDP					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	S	S	S	S	S	S
						

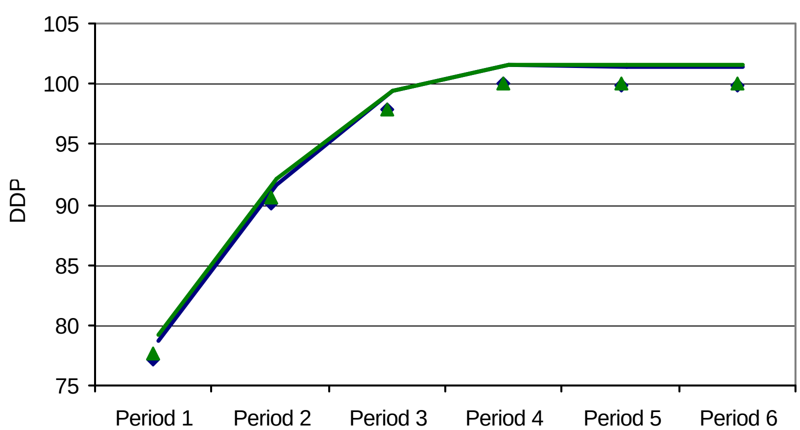
Observations:

- For profit: There are no consequences of delayed information.
- For DDP: There are no consequences of delayed information.

Fig.A14 - Order Level; Dataset delayed 8 months / Baseline policy (for profit and DDP).

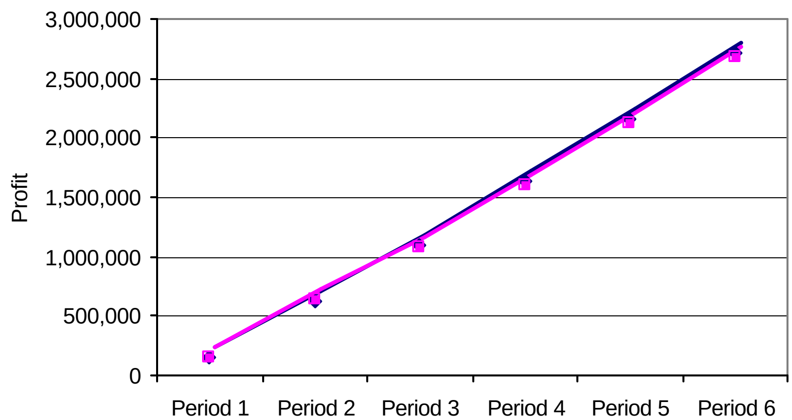
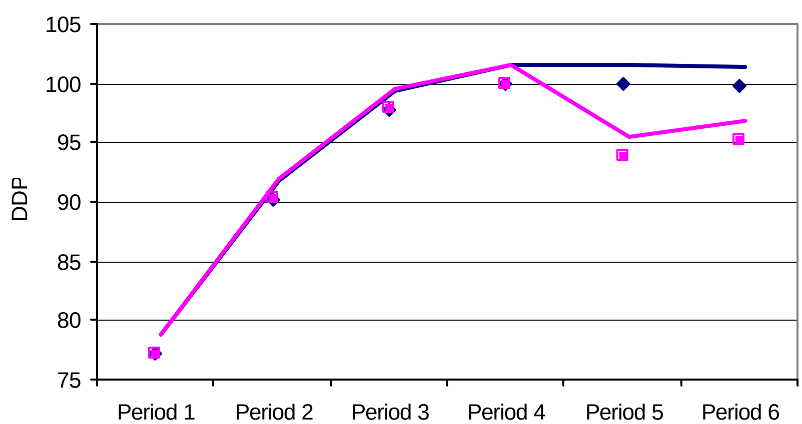
	Baseline policy (10 runs)					
Order Levels Delayed 8 months (10 runs)	Metric: Profit					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	S	S	S	S	S	S



	Metric: DDP					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	S	S	S	S	S	S
						

Observations:
- For profit: There are no consequences of delayed information.
- For DDP: There are no consequences of delayed information.

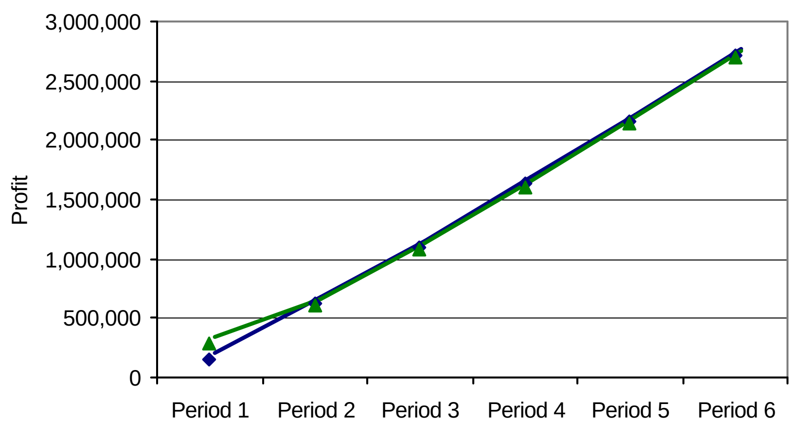
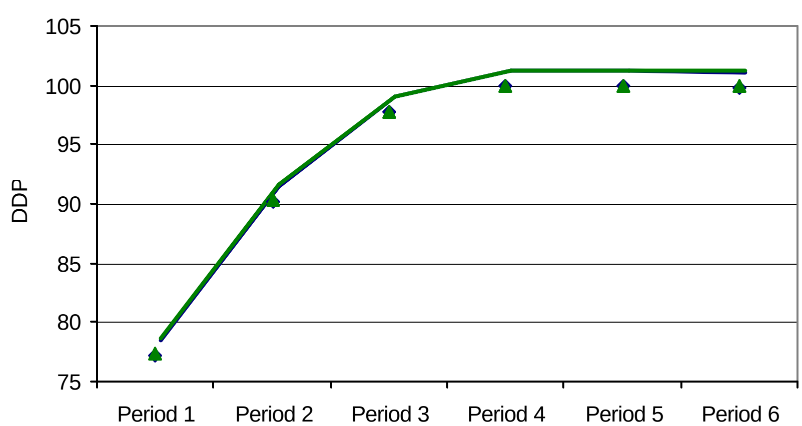
Fig.A15 - Order Level; Dataset wrong half / Baseline policy (for profit and DDP).

	Baseline policy (10 runs)					
Order Levels Wrong half (10 runs)	Metric: Profit					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	S	S	S	S	S	S
						
	Metric: DDP					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	S	S	S	S	S	S
						

Observations:

- For profit: There are no consequences of wrong information.
- For DDP: There are no consequences of wrong information. The strange pattern that can be seen in period 5 and 6 for “wrong half” is explained by some outlaying measures, which modify the average shown in the graph but not the statistical analysis.

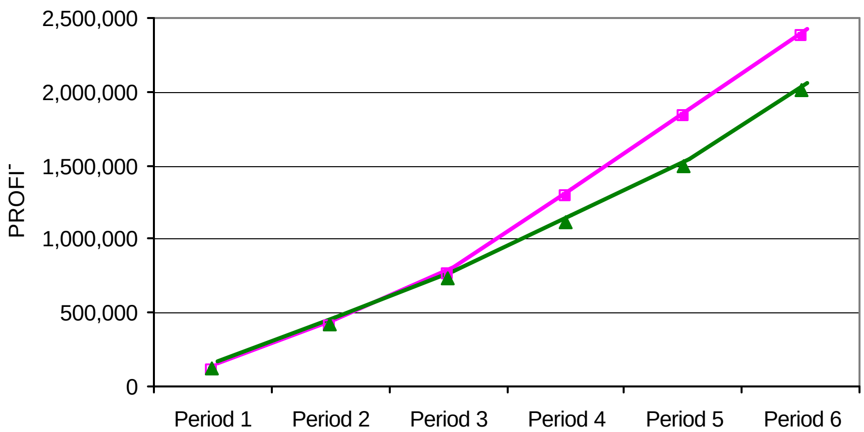
Fig.A16 - Order Level; Dataset wrong double / Baseline policy (for profit and DDP).

	Baseline policy (10 runs)					
Order Levels Wrong double (10 runs)	Metric: Profit					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	S	S	S	S	S	S
						
	Metric: DDP					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	S	S	S	S	S	S
						

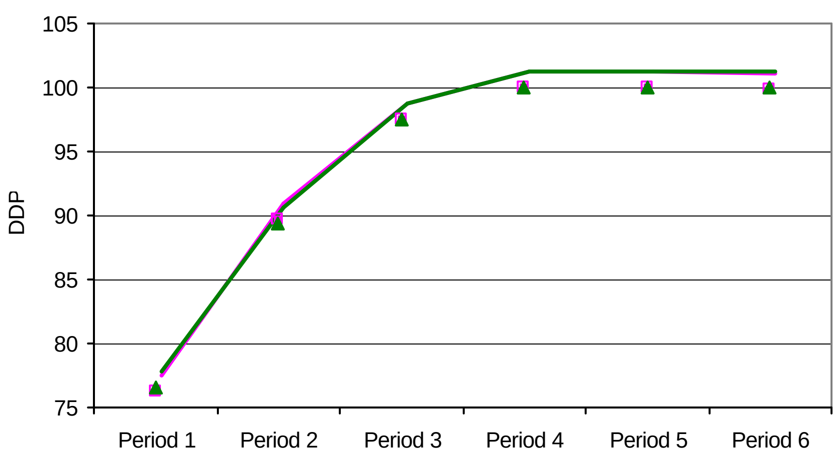
<u>Observations:</u>
- For profit: There are no consequences of wrong information.
- For DDP: There are no consequences of wrong information.

Fig.A17 - Prices; Dataset delayed 4 months / Dataset delayed 8 months

	Prices Delayed 4 months (10 runs)					
Prices Delayed 8 months (10 runs) Metric: Profit						
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	S	S	S	D -	D -	D -



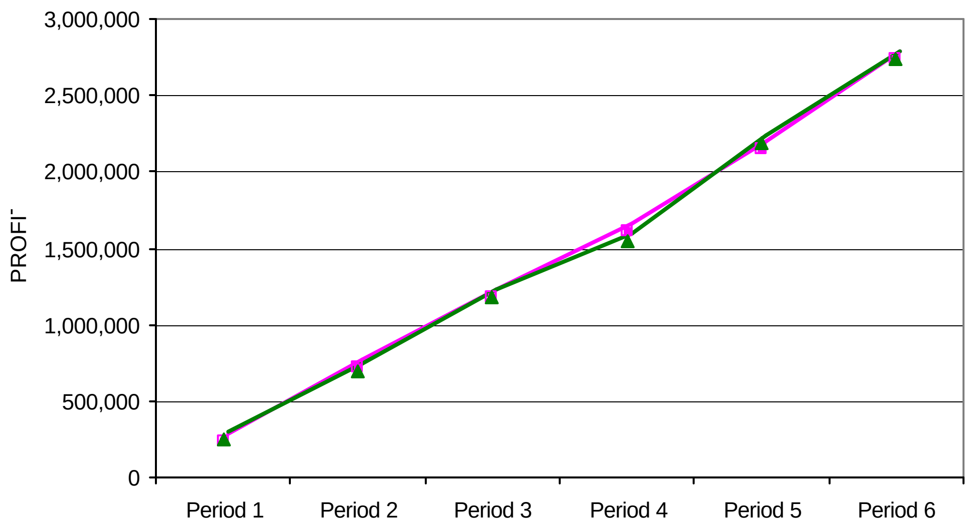
	Metric: DDP					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	S	S	S	S	S	S

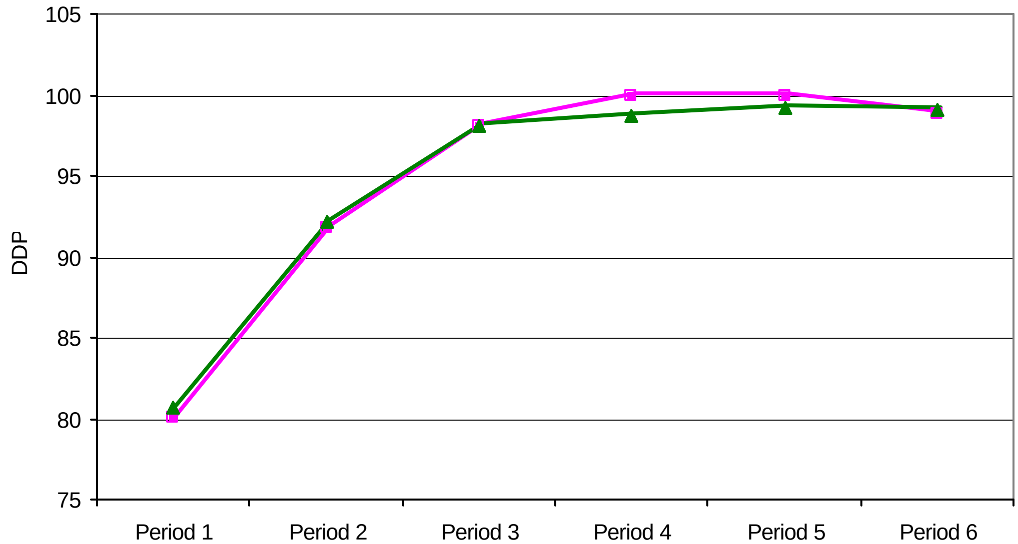


Observations:

- For profit: Length of delay has influence on the performance.
- For DDP: Length of delay has no influence on the performance.

Fig.A18 - QLT; Dataset delayed 4 months / Dataset delayed 8 months

	QLT Delayed 4 months (10 runs)					
QLT Delayed 8 months (10 runs) Metric: Profit						
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	S	S	S	S	S	S
						
	Metric: DDP					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	S	S	S	S	S	S

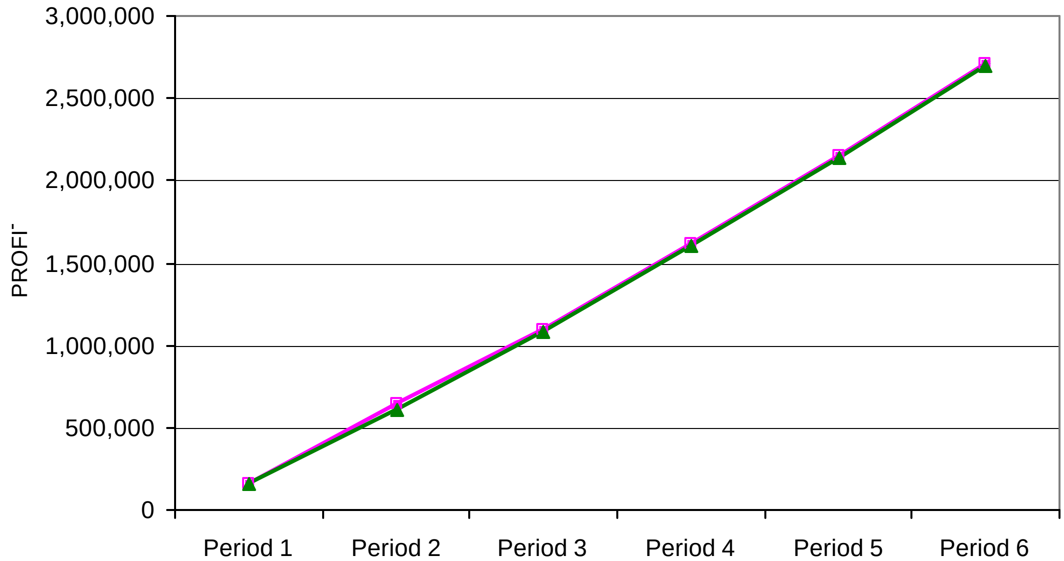


<u>Observations:</u>

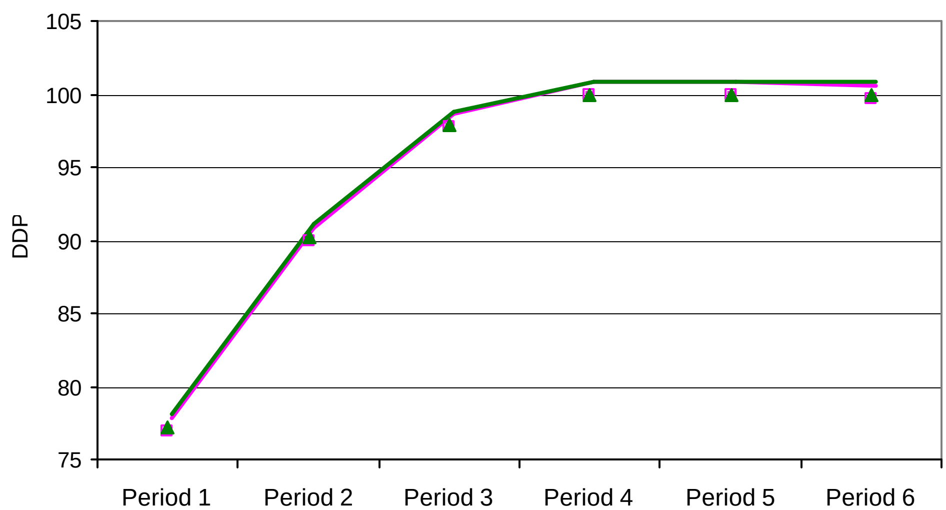
- For profit: Length of delay has no influence on the performance.
- For DDP: Length of delay has no influence on the performance.

Fig.A19 - Batch Size; Dataset delayed 4 months / Dataset delayed 8 months

	Size of Batch Delayed 4 months (10 runs)					
Size of Batch Delayed 8 months (10 runs) Metric: Profit						
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	S	S	S	S	S	S



	Metric: DDP					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	S	S	S	S	S	S

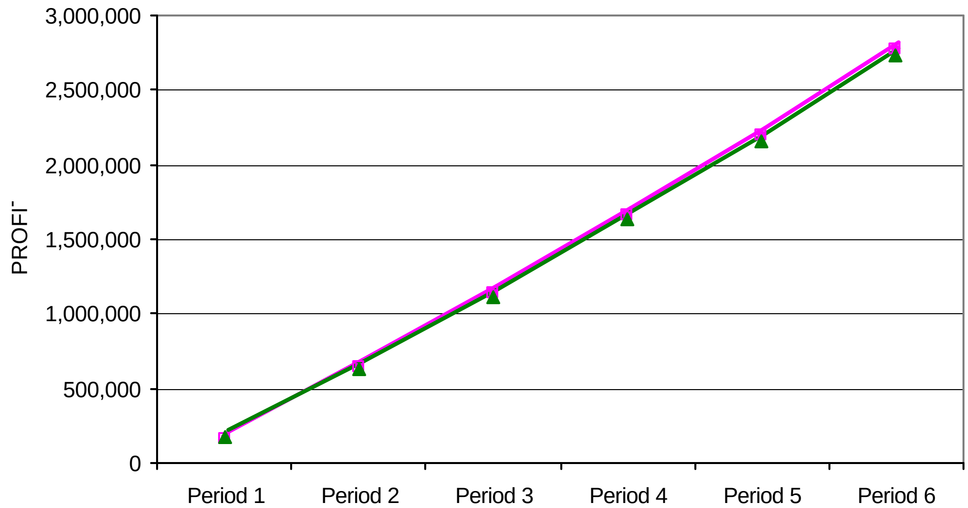


<u>Observations:</u>

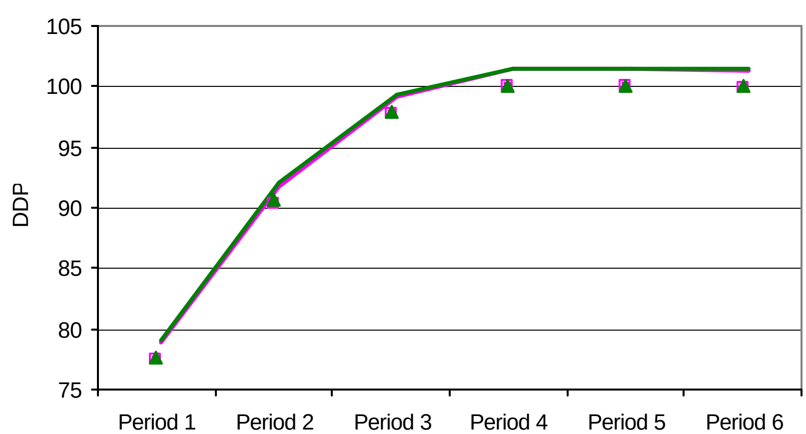
- For profit: Length of delay has no influence on the performance.
- For DDP: Length of delay has no influence on the performance.

Fig.A20 - Order Level; Dataset delayed 4 months / Dataset delayed 8 months

	Order Levels Delayed 4 months (10 runs)					
Order Levels Delayed 8 months (10 runs) Metric: Profit						
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	S	S	S	S	S	S



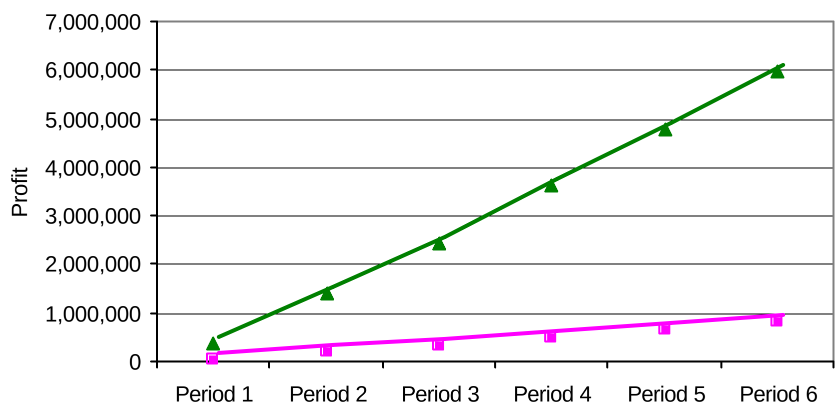
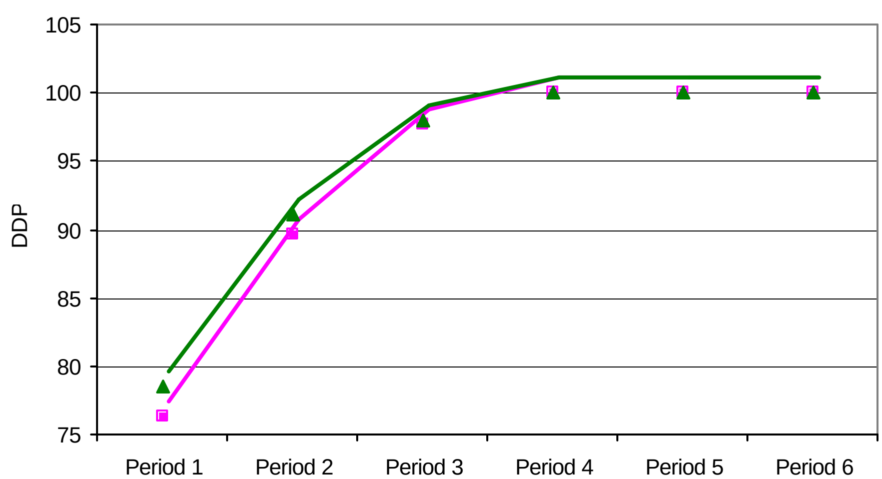
	Metric: DDP					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	S	S	S	S	S	S



Observations:

- For profit: Length of delay has no influence on the performance.
- For DDP: Length of delay has no influence on the performance.

Fig.A21 - Prices; Dataset wrong half / Dataset wrong double

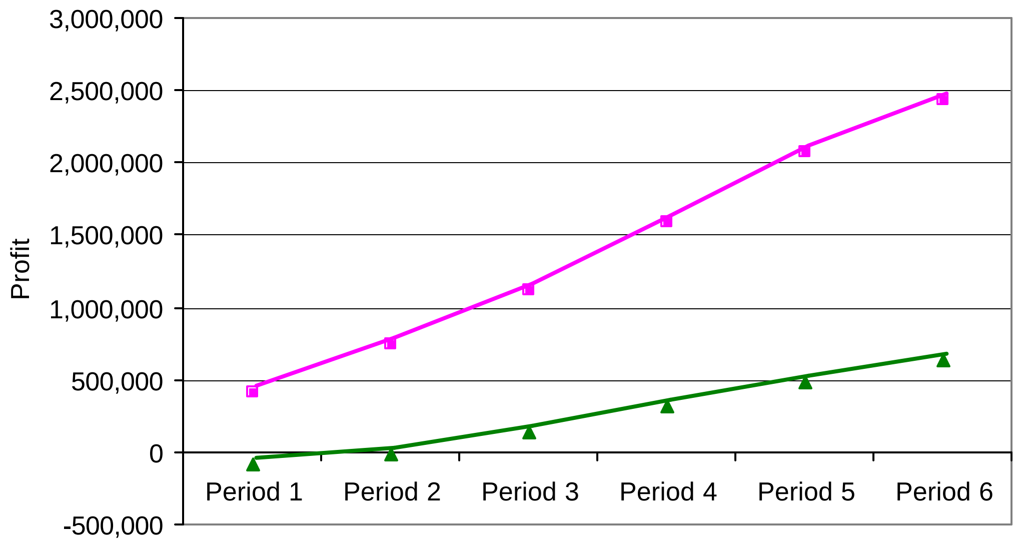
	Prices Wrong half (10 runs)					
Prices Wrong double (10 runs)	Metric: Profit					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	D +	D +	D +	D +	D +	D +
						
	Metric: DDP					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	D +	D +	S	S	S	S
						

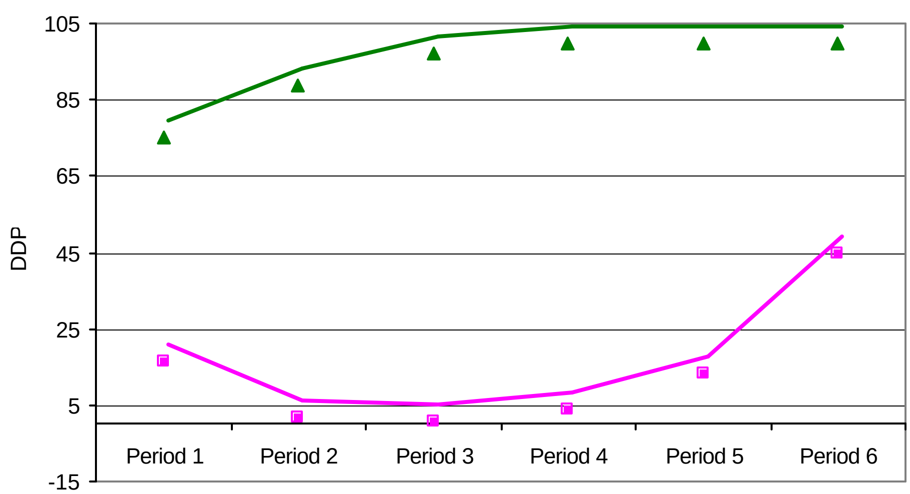
<u>Observations:</u>

- For profit: Error size has a great influence on the performance.
- For DDP: Error size has influence on the performance in the short term only.

Fig.A22 - QLT; Dataset wrong half / Dataset wrong double

	QLT Wrong half (10 runs)					
QLT	**Wrong double (10 runs)** Metric: Profit					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	D -	D -	D -	D -	D -	D -



	Metric: DDP					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	D +	D +	D +	D +	D +	D +
						

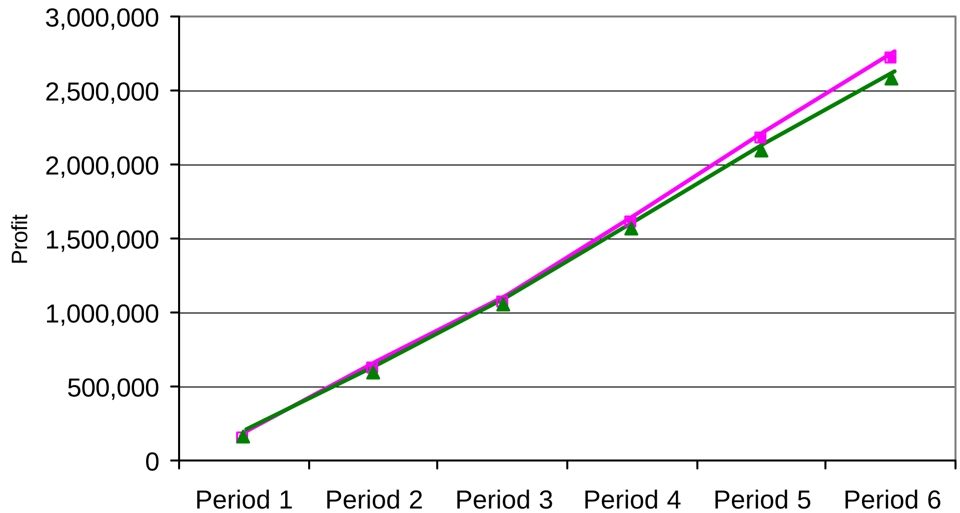
<u>Observations:</u>

- For profit: Error size has a great influence on the performance.

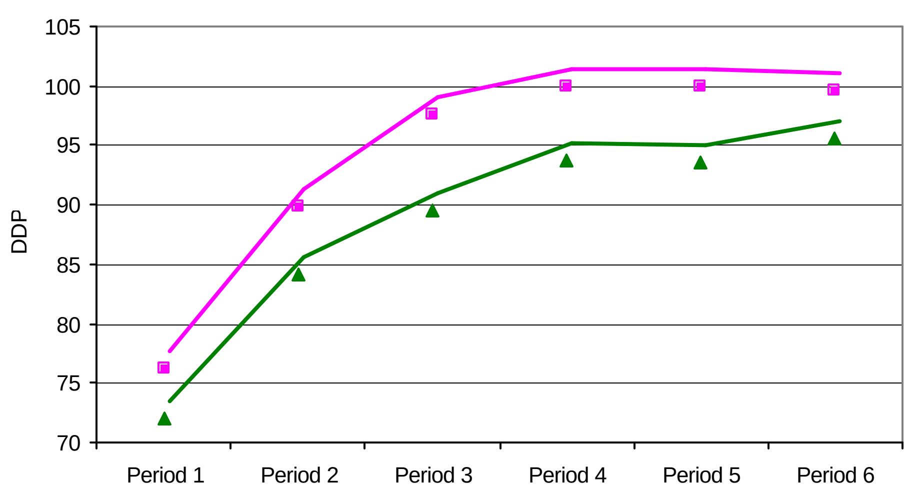
- For DDP: Error size has a great influence on the performance.

Fig.A23 - Batch Size; Dataset wrong half / Dataset wrong double

	Size of Batch Wrong half (10 runs)					
Size of Batch Wrong double (10 runs)			Metric: Profit			
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	S	S	S	S	S	D -



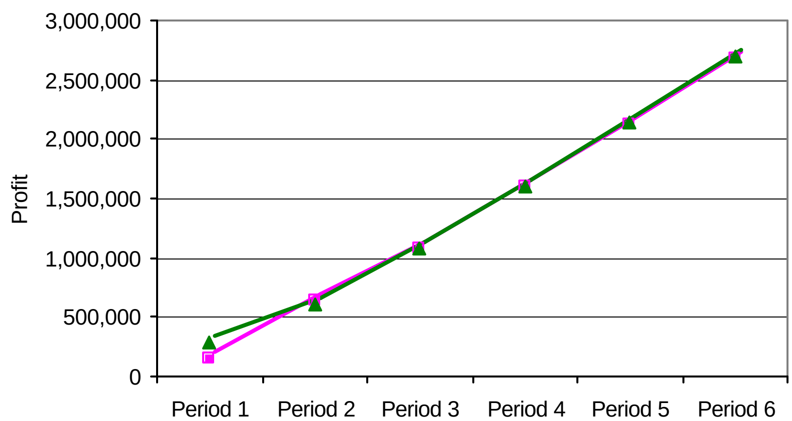
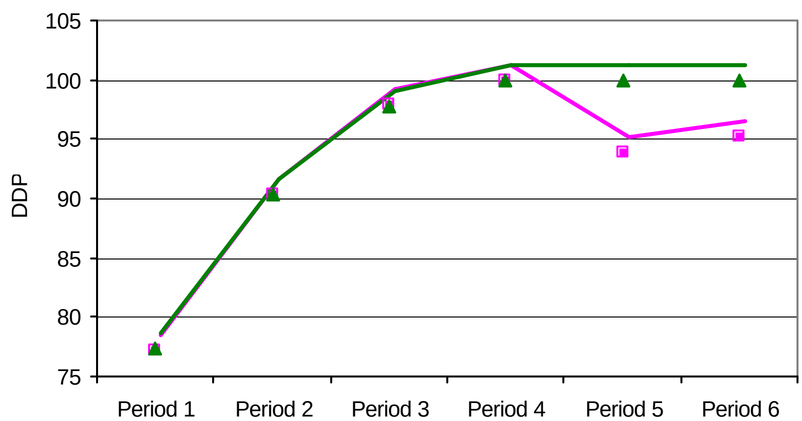
	Metric: DDP					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	D -	D -	D -	D -	D -	D -



Observations:

- For profit: Error size has influence on the performance in the long term.
- For DDP: Error size has a great influence on the performance.

Fig.A24 - Order Level; Dataset wrong half / Dataset wrong double

	Order Levels Wrong half (10 runs)					
Order Levels Wrong double (10 runs)	Metric: Profit					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	S	S	S	S	S	S
						
	Metric: DDP					
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
	S	S	S	S	S	S
						

<u>Observations:</u>

- For profit: Error size has no influence on the performance.
- For DDP: Error size has no influence on the performance. The strange pattern in period 5 and 6 for "Wrong half" is explained by outlaying measures, which modify the average shown on the graph but not the statistical analysis.