

Whitepaper

Risk Analysis using the DuPont model

**Talking the language of the business
using financial models for risk analysis**

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This whitepaper outlines the importance of understanding the financial impact of information security risks. We have used the DuPont model to describe this because it gives you an understanding of the relationship between incidents and how it has an impact on profitability. To use the model you need to have knowledge about accounting and financial reporting together with an experience of working with risk scenario(s) and how IT is affected by it.

The Risk Analysis approach

The risk analysis process is about identifying potential scenario(s) and assessing the likelihood and impact for them where the risk is the results from the process. There are two types of approaches to risk analysis:

- *Quantitative:*
With this approach you estimate the percentage of the probability and then add quantified value for the asset, damage impact, cost in case of an incident. With this approach you will receive a residual risk value for potential incidents.
- *Qualitative:*
With the qualitative approach you don't spend time to estimate values, instead you estimate the probability and impact for incidents and that forms the risk level. Often you use a High, Medium, Low or a 1 to 10 scale to describe the risks.

The argumentation of why to use one method or the other depends on who is responsible for it, the target audience of the results and the environment you work in. There is though one priority for the analysis and that is to reduce costs that are initiated by a specific incident. It implies that you must understand how it affects the profit & loss statement together with the balance sheet. This is something that is not addressed in the risk analysis approaches mentioned above. With the quantitative approach you will get a value but still you will not understand how it will hit you from a financial point of view. This is where the DuPont model comes in.

The DuPont model

For any business in the private sector there are numerous of models to describe how well the business is running. Among these the DuPont model was created in the early 1900s but is still a model valid to use for assessment of the profitability. Using the DuPont model for risk analysis is not very common but if you as a risk analysis specialist wants to talk the language of the business, it can be valuable to you.

The model was created by F. Donaldson Brown who came up with the model when he was assigned to clean up the finances in General Motors and has ever since been an important model for financial analysis. Remarkably it has not been used in the security community for risk prioritization or impact analysis. Regarding this fact we have taken the challenge to use the model for our research.

The DuPont model is described in the figure below, where the different components are presented:

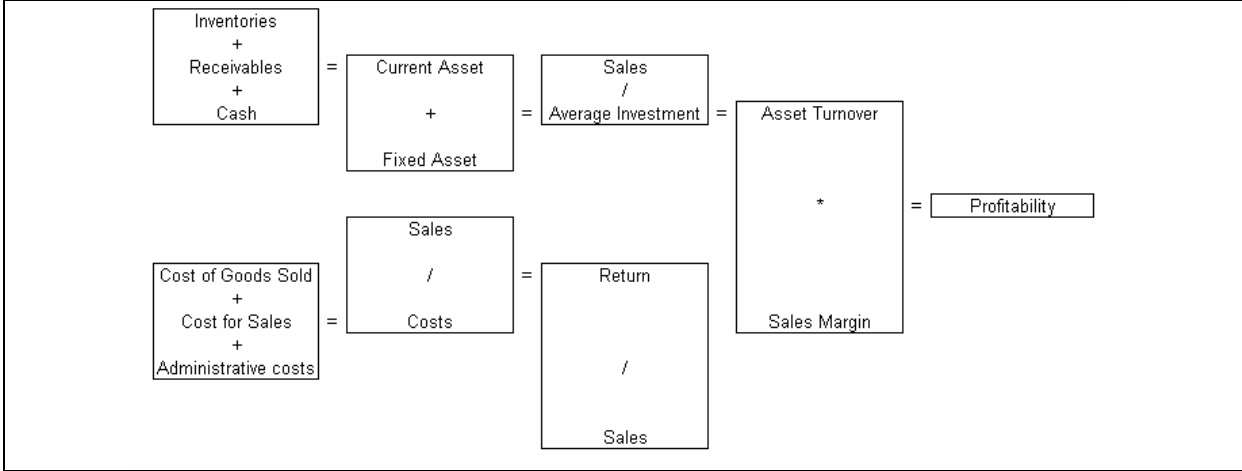


Figure 1. The DuPont Model

The financial impact in risks analysis

One concern with risk analysis is that you often end up in a situation where you talk about things that do not exist and it is often hard to make people understand that it can become a reality. Even if we have seen the most unlikely incidents take place it is common that people believe that it cannot happen to them.

In our research we have built an assessment model where we are able to run simulations to understand the impact for different risk scenario(s). One problem we identified was that when you talk about the financial impact, then it can be described in several steps. To show you this we will walk through a scenario where there is a major downtime for a critical server:

Step	Scenario	Potential financial impact
1	The server goes down and on-line sales is not available resulting in lost revenues.	Lost sales volumes to a degree based on average sales using rolling 12 month values
2	Some of the lost sales is possible to recover	Estimated ratio: 30 % recovered and 70 % lost sales
3	Lost sales leads to higher inventory value on short term	Increase in inventory value based on average turnover rate for goods in stock.
4	Lost sales leading to reduced accounts receivables values	The level meets the lost sales volume estimated from step 1 and 2.
5	Reduced accounts receivables values leads to less cash (i.e. lost sales means no cash)	The level is based on the reduced accounts receivables values in step 4
6	Items with a short lifetime must be sold without profit or even with a loss	Loss of margin based on estimate on prior experience from sales

When you use the DuPont model you can choose between describing all the details in the scenario or pick the key issues. In this case it would be most interesting to see the impact when you loose sales for one day, one week and one month. For this time range you can focus on the impact on lost sales and taking recovered sales into account. The impact on the balance sheet is important but that may be out of the pictures to describe the direct impact.

Assessing the financial impact

The first step in our assessment is to get an understanding of how it look right now and we need to know where an incident will hits us the hardest. In figure 2 you can see that a 10% change will have the highest impact on sales, even if you calculate both the sales and the reduced cost of goods sold. Next to sales you can see that cost of sales have a higher impact than administrative cost of the simple reason that we spend more money there. If you look at the balance sheet items you can see that fixed asset has the highest impact in this simulation and that is also caused by the structure of the balance sheet for the specific business.

	Sales		Asset		Decrease (-10%)	Before	Increase (+10%)		Asset		Sales Margin
	Margin	Turnover	Profitability	Turnover			Profitability	Turnover	Margin		
Sales	-60,6%	-10,0%	-64,5%		-1000	10 000	1000	64,5%	10,0%	49,6%	
Cost of Goods Sold	37,4%	0,0%	37,4%		-580	5 800	580	-37,4%	0,0%	-37,4%	
Cost for Sales	11,6%	0,0%	11,6%		-180	1 800	180	-11,6%	0,0%	-11,6%	
Administrative costs	5,5%	0,0%	5,5%		-85	850	85	5,5%	0,0%	-5,5%	
Fixed Asset	0,0%	5,4%	5,4%		-1200	12 000	1200	-4,9%	-4,9%	0,0%	
Inventories	0,0%	4,0%	4,0%		-900	9 000	900	-3,7%	0,0%	-3,7%	
Receivables	0,0%	0,6%	0,6%		-150	1 500	150	0,6%	0,6%	0,0%	
Cash	0,0%	0,4%	0,4%		-100	1 000	100	-0,4%	-0,4%	0,0%	

Figure 2. Change of 10%

Walking through scenarios

Now as we know the priorities of where an incident will hit you in the financial reports, we can walk through a couple of scenarios.

Case 1 - Fixed assets damaged

In the first case we have used a datacenter damaged by fire as the scenario.

	Simulation 1		Simulation 2	
	Change	Before	Change	Before
Sales	0,00	10000	0,00	10000
Cost of Goods Sold	0,00	5800	0,00	5800
Cost for Sales	0,00	1800	0,00	1800
Administrative cost	320,00	850	420,00	850
Fixed Asset	-320,00	12000	180,00	12000
Inventories	0,00	9000	0,00	9000
Receivables	0,00	1500	0,00	1500
Cash	0,00	1000	0,00	1000
Asset Turnover	43,14% (1,4%)	42,6%	42,23% (-0,8%)	42,6%
Sales Margin	12,3% (-20,6%)	15,5%	11,3% (-27,1%)	15,5%
Profitability	5,31% (-19,5%)	6,6%	4,77% (-27,7%)	6,6%

To calculate the impact we have identified the value of damaged asset to an origin value of 800. After depreciation (3 year old equipment, 2 years left) we must write-off 320 and the cost must be taken as administrative costs. With only these factor included the profitability goes down with 19,5%.

$$\text{Fixed assets: } -(800/5)*2 = -320$$

$$\text{Administrative costs: } (800/5)*2 = +320$$

If the equipment is replaced with new but to a better price, the impact is higher as the profitability goes down with 27,5%. In this case we have calculated new equipment 500 instead of the 800 we had to pay in the first simulation together with the write-off for the old one Then we have both the write-off with 320 and depreciation for the new one.

$$\text{Fixed assets: } 500-320 = +180$$

$$\text{Administrative costs: } (500/5)+320 = +420$$

Case 2 - Lost sales

Now we have a scenario that is linked to the first one but here we will only look at the impact if we loose sales for a defined period of time.

In this case we loose sales for 5 days that we cannot recover. This will affect cost of goods sold. As it is a relative short time range we are not able to stop new deliveries of goods so our inventories will also increase. In this first simulation it will reduce our profitability with -4%.

$$\text{Sales: } -(10000/365)*5 = -136,99$$

Cost of Goods Sold:

$$-(5800/365)*5 = -79,45$$

$$\text{Inventories: } (5800/365)*5 = +79,45$$

	Simulation 1		Simulation 2	
	Change	Before	Change	
Sales	-136,99	10000	-410,96	
Cost of Goods Sold	-79,45	5800	-238,36	
Cost for Sales	0,00	1800	73,97	
Administrative cost	0,00	850	34,93	
Fixed Asset	0,00	12000	0,00	
Inventories	79,45	9000	119,18	
Receivables	0,00	1500	0,00	
Cash	0,00	1000	0,00	
Asset Turnover	41,83% (-1,7%)	42,6%	40,6% (-4,6%)	
Sales Margin	15,13% (-2,4%)	15,5%	13,23% (-14,7%)	
Profitability	6,33% (-4%)	6,6%	5,37% (-18,6%)	

If the problems continues we will be able to mitigate the impact to some degree but at the same time other costs will emerge. Here we have estimated a 15 days downtime, but now we are able to stop 50% of the deliveries to us. Because the downtime is so long we have also been forced to work harder to keep our existing customers (visits, advertising) and hire staff/consultants to be able to keep up with the administrative work while we are not able to work according to our ordinary streamlined processes. With all of this at the same time the profitability goes down even more and it stops at 5,37%, a loss of -18,6%.

$$\text{Sales: } -(10000/365)*15 = -410,96$$

$$\text{Cost of Goods Sold: } -(5800/365)*15 = -238,36$$

$$\text{Cost for Sales: } (1800/365)*15 = +73,97$$

$$\text{Administrative costs: } (850/365)*15 = +34,93$$

$$\text{Inventories: } =238,36/2 = +119,18$$

Case 3 - Lost sales and fixed assets damaged

Finally we have combined the fixed assets damaged in case 1 and the lost sales in case 2 because they are linked to each other and they also outline that there should be a business continuity plan in place to mitigate the impact.

	Simulation 1		Simulation 2	
	Change	Before	Change	Before
Sales	-136,99	10000	-410,96	
Cost of Goods Sold	-79,45	5800	-238,36	
Cost for Sales	0,00	1800	73,97	
Administrative cost	420,00	850	774,93	
Fixed Asset	180,00	12000	-140,00	
Inventories	79,45	9000	119,18	
Receivables	0,00	1500	0,00	
Cash	0,00	1000	0,00	
Asset Turnover	41,51% (-2,4%)	42,6%	40,84% (-4%)	
Sales Margin	10,87% (-29,8%)	15,5%	5,51% (-64,4%)	
Profitability	4,51% (-31,6%)	6,6%	2,25% (-65,9%)	

In simulation 1 (5 days downtime) the profitability goes down with 31,6% which is driven to a higher level than described in case 1 and case 2 due to replacement of fixed assets. In simulation 2 (15 days downtime) the impact becomes even higher where the profitability goes down with 65,9%. Here the additional costs for sales and administration are the factors that affect the profitability.

Now if we return to the Dupont model, Figure 3 describes more in detail how this will affect the business. We have used the worst case scenario to really push it to the edge.

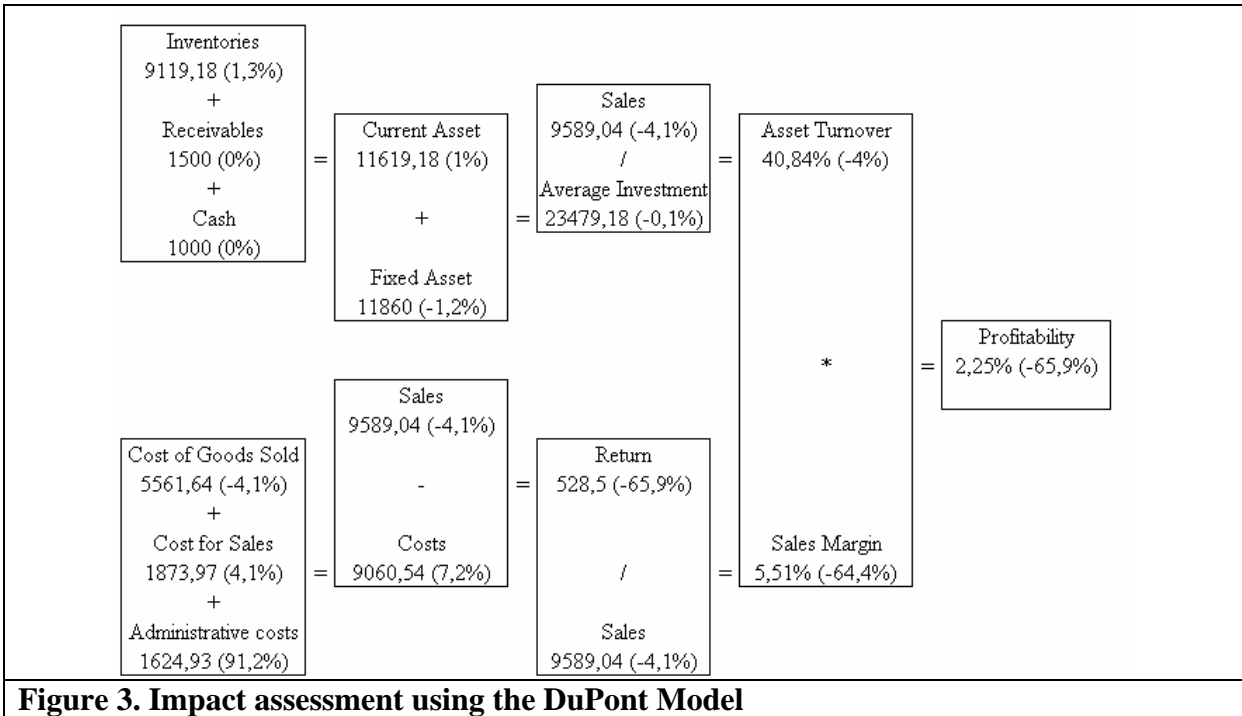


Figure 3. Impact assessment using the DuPont Model

When you take a closer look at the model you can see that the most important factor that drives the impact on profitability is the sales margin. To mitigate the impact in this specific business case the Business Continuity Plans should be reviewed and updated to meet the current threats with a special attention on sales and delivery.

Conclusion

The DuPont model reveals the pain you will suffer from an incident that is realized. There is a lot more to discover using the model and our experience so far has been that it is an excellent approach to talk the language of the business when you deal with risks. The key obstacle is to find people who understand financial issues, security related scenarios and how IT is involved in all of this.

There are some key points that have emerged in our assessments and that is:

- You must have an understanding of the key values in the balance sheet and the profit and loss statement. If your business requires high investments in fixed assets then you have to do more work in this area than others, if your business requires major investments in inventories then that should be your focus.
- Understand how sales, cost of goods sold and inventories are linked together. What happens if you cannot sell for a day, a week or a month?
- Don't be afraid to use high numbers when you're in a workshop. The signal it sends to the attendees is an alarm bell that will keep on ringing until you have understood the scenarios and their impact for the business.
- Do not stop with this impact assessment. Continue with regular risk analysis using a quantitative or qualitative approach. In the end you will have management attention on these issues and it will be possible to sign off an accepted level of risk.

Finally we believe that there is a lot more to learn from our approach using financial models to assess risks in a business environment.

About Scillani Research

The life and blood of Scillani is to know more, to be able to deliver up-to-date services and solutions. Our research effort is often based on generally accepted standards and methods and our mission is to capitalize its essence into commercial sound services and solutions. We also believe that professionals with an ambition to know more want to develop their skills by combining research work with consultancy assignments or development.

A lot of the output from research is not top secret, because it is based on generally accepted standards and methods. Therefore the results will be available for the general public through our reports, whitepapers, study guides, seminars and other measures to communicate what we have learned.

Last but not least, we want to know more and we are interested in partners for future research projects. Our target lists for projects is expanding each day but our time is limited so we are always looking for partners in these projects. If you are interested then you can write to us: info@scillani.se.