Applications and Benefits

Benefits of Simulation

The purpose of this document is to provide manufacturers insight into how much benefits may be achieved by applying simulation techniques. The approach is to look at the recent completed industrial cases and highlight the quantitative benefits that the customers have announced. This information could be reflected to readers own case to estimate likely benefits of similar application.

The quantitative information has been collected from:

- Public material: conference papers, internet sites, case studies published by simulation providers. This survey was concentrated on the process industry.
- Success stories that Sim-Serv Members have published in the Sim-Serv web site. These projects have been done in piece part manufacturing and process industry alike.
- Sim-Serv test case projects in various industry sectors and application areas

All together over hundred industrial projects have been scrutinized. In that dataset 30-40 projects report clear quantitative benefits. These have been presented in the table below. The table contains the name of the user and the country of residence of the user. The name of the user links to the project database entity. By clicking that link you can get additional information of the case including the reference to the original project description document. It must be noted that in some cases the name of the user has not been mentioned due to confidentiality.

In the benefits table the problem that was solved is briefly described. The metric that has been used to measure the benefits and the value of it has been provided. This is usually in terms of percentage improvement.

The projects have been grouped according to the type of application. Somebody could argue that all the methods used are not simulation. That may be true but we do not see any benefit in restricting very strictly to some methods. This summary is intended for potential industrial users. Therefore we are looking at the field of mathematical methods rather broadly.

The classification of the applications is difficult because there are so many different applications and sometimes even several approaches have been used within one project. The application classes used in this summary have been:

SCHEDULING

Case	Problem	Indicator	Value
Danisco, Denmark	The optimal operation of a complex batch process for producing sweeteners.	Product yield increase	2-3 %

Lahden Lasitehdas, Finland	The optimal production schedule at a glass manufacturer.	Cost savings	160,000 €/ year
McDougalls, UK	Effective production planning and stock management when demand is erratic at a manufacturer of pre-packed flour.	Cut in stocks	70%
Merck, Germany	Complex production portfolio, low utilisation level at a fine chemicals producer.	Capacity increase (in an example plant)	130 %
Decorpart, UK	To improve competitive position high efficiency and low cost need to be ensured in production of small aluminium parts.	Reduction of raw material in stock	50%
		On time in full deliveries increased (from 30% to 80%)	170%
Auto1 producer, Germany	Need to reduce costs and cycle times of car painting.	Less changes of colour in the painting station	8%
		Output of the painting station increased	12%
		Reduction of operating costs	12%
		Payback time (months)	8

PRODUCTION OPTIMISATION

Case	Problem	Indicator	Value
Kuusakoski, Finland	Management of mixture ration of feed components due to varying quality of raw material at an aluminium producer.	Savings in raw material costs	2 %
		Increase in recycled raw material usage	40 % (from 35% to 50% of the final product)
Dye Manufacturer	Management of 100 master recipes needed to be enhanced.	Increase in production output	40%
		Savings in planning efforts (personnel costs)	80%
UPM-Kymmene, Finland	Minimisation of trim-losses at converted paper manufacturer.	Cost savings	1,7 Million €/ year
		Capacity increase	12,5 %
Teknikum, Finland	The need for better understanding and control of production of rubber and plastic parts.	Savings in manufacturing costs	20-30 %
		Shortened time to market	30-50 %

Billerud, Sweden	Energy savings were looked for at a pulp producer.	Energy savings	10 %
Soraluce S.Coop.	The need for reduction of machining time and costs.	Reduced machining time of a part	25%
		Reduced production costs	78%
Agilent Technologies	The need to reduce the long assembly time of fibre optic cables caused by the labour-intensive task of coupling the laser with the core of the fibre.	Success rate of automatic alignment system	100%
		Reduced time for linking components (from 5 minutes to 30 seconds)	90%
Jelcz, Poland	The production line for swivel axles needs to be improved.	Reduction of manufacturing cost	37%
		Increase machine utilisation	10%
		Reduction of work in progress	90%
		Increase utilisation of labour (from 40% to 80%)	100%
		Reduce labour costs	56%
Spamel, Poland	Need to reduce production costs and to increase capacity of production line.	Reduce assembly lead time	60%
		Inventories between single assembly processes	Eliminated
CERAMTEC, Germany	Need to reduce delivery time and operational costs.	Reduce work in progress (WIP)	30-40%

DATA RECONCILIATION

Case	Problem	Indicator	Value
Erdöl-Raffinerie-Emsland, Germany	Precision of the feed gas composition measurement needed to be improved at a hydrogen producer.	Energy savings	0,5 million euro/ year
WACKER-Chemie	The analysis cost needed to be cut at an acetyl acetone producer.	Number of routine analysis	-50 %
Erdöl-Raffinerie-Emsland (2), Germany	The accurate evaluations of heat and mass balances could not be made due to lack of information of process and flow conditions at a sulphur producing unit.	Accuracy of yield amount	0,1 %
KKL-Leibstadt,	Reliable evaluations of the reactor power were	Cost savings	$2 million/

Switzerland	needed to safe and effective operation at a nuclear power plant.		year

DESIGN

Case	Problem	Indicator	Value
Lurgi Oel-Gas-Chemie	More intensive project execution times were looked for at a process engineering company.	Decrease in project duration	20 %
WACKER-Chemie	Acetyl acetone reactor design needed to be modified.	Capacity increase	14 %
Merck	Complex production portfolio, low utilisation level at a fine chemicals producer.	Reduction in design costs	5 %
Rolls-Royce (VTT case base)	More effective product development for jet engines was looked for.	Decrease in product development time (from 15 to 9 months)	40%
Kaeser Kompressoren	The design of a new production line of compressors needed to be optimised.	Decrease in production line design time (from 24 to 8 months)	67%
		Throughput time was reduced as compared to the initial design (before simulation)	8%
		Buffer capacities were reduced as compared to the initial design (before simulation)	12%
		Investment cost was reduced as compared to the initial design (before simulation)	6%
		Pay back time was less than 6 months	<6
Bayo Jewellery	Production process in jewellery needed to be optimised.	Reduction of production time of a new design (from 12 weeks to 3 weeks)	75%
A. Schulman GmbH	Support rail of a bus made from aluminium was to be replaced by a fibre reinforced plastic part. The aim was to reduce weight and cost.	Reduction of weight	30%

MODIFICATION STUDIES

Case	Problem	Indicator	Value

Rhone-Poulenc	Capacity increase were looked for by identification of operating parameters at an agricultural products producer.	Capacity increase	8 %
Hewlett Packard	Increase of output on a final inkjet cartridge assembly line with minimal investment.	Increase in output	15%
		Cost savings	40M€/year
		Project cost	9000€
		Payback time	<1 day
Cloth company, Italy	Need to reduce distribution and handling costs by reducing the number of delivery boxes needed in order sorting and shipping process.	Number of boxes	-20%
		Reduced recirculation	-30%

SUPPLY CHAIN MANAGEMENT

Case	Problem	Indicator	Value
NOVA Chemicals	Help for providing supply chain and ensuring proper lead times and product delivery at an ethylene/ polyethylene producer.	Benchmark study	Within the first quintile
Major Italian retailer	Need for improving customer satisfaction and optimising the supply chain.	Reduction of stock-out	50-80%

PRODUCT QUALITY

Case	Problem	Indicator	Value
Billerud	More uniform quality pulp were looked for.	Decrease in Kappa variation	45 %

WORK ORGANISATION

Case	Problem	Indicator	Value
Drilling machine repair shop	The service level and utilisation of workers needed to be improved with zero investment cost.	Increase of today-in today-out rate (initially 71%) by	20-25%
		Decrease of idle time (initially 5,2%) by	44%
		Reduction of average lead time (from 4.9 days to 2.9 days)	41%
Airplane parts	Needed more effective personnel	Number of products (from	12%

manufacturer	structures to respond larger number of products.	500 to 560)	
		Increase in output	5%
		Increase in labour utilisation	5%

OPERATOR TRAINING

Case	Problem	Indicator	Value
Light hydrocarbon gases producer	The need to reduce the training period of new operators on fluid catalytic cracker (FCC)	Cost savings	$40 000/ operator
BP Chemicals, UK	The operators needed to handle wide range of operations at an ammonia and carbon monoxide plant.	Reduction in lost production	1 week/year
		Reduction of plant trips	6 trips/year