## Modelling consumer complaints in FMCG

### Executive summary

This project successfully analysed and proposed improvements to the current practice of detecting increases in consumer complaints at FMCG producer Beiersdorf. Consumer complaints contain feedback from the market, and detection of possible product issues through increases in complaints is crucial for long-term consumer satisfaction.

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### Challenge overview

Beiersdorf has consumers in all continents of the world. Being the leader in skin care, feedback from consumers can help the company retain and strengthen its position. In collecting consumer complaints for all products, Beiersdorf has a repository of information that can help signalling product issues and improvement opportunities. The Product Quality Improvement team wanted to improve their detection of product issues through a robust model. In addition, the current approach needed to be assessed.

### The problem

The objective was to learn from sales and complaint data, in order to develop a diagnostic for product issue detection. Beiersdorf sells more than a thousand different varieties of its products in countries worldwide. Though strict quality control is used in the manufacturing, sometimes products that do not live up to the standards end up at the consumer’s table. The reason can stem from various sources; transportation handling, change in the production or product composition, consumers using the product inappropriately or simply a new design that is not appreciated. Regardless of cause, it is important that customer dissatisfaction is reduced and product quality is maintained. Consumer complaints form a second stage (after production control) of feedback to Beiersdorf. Products that, for one reason or another, do not live up to the consumer expectations need attention. An increase in the number of complaints for a product is an indication that there may be a product issue. However, there is a natural variation in the number of complaints, and there are almost always a few complaints even for products that have no problem. The task therefore lies in detecting increases that do not simply stem from chance. Clearly, monthly manual analysis of hundreds of time series for many countries is simply not feasible. Therefore an analysis was carried out on a sample using regression and methods traditionally used in manufacturing: statistical process control charts.

### Results and achievements

Results are to be presented at the HQ in Germany. Though there still remains some final work on the model, implementation is scheduled to be finished by the end of 2010. Key findings include:

* Dividing complaints by average past sales is problematic. This is because the time from the unit is sold until a consumer complains tends to vary. Sometimes the relationship between sales and complaints is very hard to determine.
* The complaint data is seasonal to a large extent. This means that models or data need to be adapted in order for detection to work properly.
* In visualising the complaint data through time, the analyst gets much more insight than with the current practice which only involves year-to-year comparisons of a specific month.

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## Trend Estimation in the Tactical Horizon

### Executive summary

This project developed statistical forecasting models for FMCG manufacturer Beiersdorf. Focus of the project was on the tactical horizon (8 to 18 months ahead), hence by applying trended models forecasting accuracy is increased.



### Challenge overview

Beiersdorf (BDF) is a global fast moving consumer goods manufacturer of skin and beauty care brands, selling 100s of products across 150 affiliates worldwide. The problem of medium to long-term demand forecasting raises a number of necessities that must be properly addressed in the design of the employed forecasting methods. These include long forecasting horizons and a high number of quantities to be forecasted. This in turn limits the possibility of human intervention, frequent introduction of new products for which no past sales are available for parameter calibration and withdrawal of running products. For efficient production planning i.e. ordering of raw materials, assignment of production to various factories, managing delivery obligations, minimization of stock and etc. and a decisive basis for company policies, sales forecasting over a sufficiently long future time horizon is essential.

### Implementation of the initiative

The Lancaster Centre for Forecasting, based at the Lancaster University Management School, has as its objective, developing new methods and approaches to forecasting focused on improved organisational practices. It has been particularly concerned with evaluating and improving company forecasting systems, funded by the EPSRC and a large number of companies. It has long standing relations to support Beiersdorf HQ in Germany and its UK division through a mentoring scheme. The project was conducted by a Masters student in Management Science and Marketing Analytics who carried out a 12 week internship onsite.

### The problem

The aim of this project is to find out whether the standard assortments are trended, and if so what the best method to forecast them is. In different data aggregations, time series behave differently. The first challenge in studying trends is to find the optimal aggregation level. The optimum aggregation level should give accurate trend forecasts after a reasonable amount of effort. The focus of the study was on the tactical horizon and therefore, to determine what needs to be forecasted the information which needs to steer the supply chain planning decisions in the tactical horizon was defined. Base on the data exploration there were some brands which have consistent changes in their level of demand and thus trended.

64 different model settings were examined in the empirical analysis with use of the “Intelligent Forecaster” software. The analysis explored different algorithms of exponential smoothing and regression, and various routines for optimisation and initialisation. The Exponential Smoothing methods outperformed the Regressions.

### Results and achievements

Results were presented to the HQ in Germany. Key outcomes include:

* The optimum aggregation level to investigate standard assortment trend for tactical horizon.
* Automation of trend detection on the high- demand products using the statistical tests in the “Intelligent Forecaster” software.
* Optimal model parameters for aggregated forecasting in the tactical horizon.

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## Econometric Models Building for British Gas Call Centre

### Executive summary

This project successfully developed econometric models in identifying the key drivers which have some impacts on weekly incoming call volumes in British Gas. The findings of this project will be useful for the long term business and scenario planning for the Call Centre staff scheduling in British Gas.



### Challenge overview

Call centres play a major role in the way many businesses operate. It has also become one of the most common interfaces between businesses and their customers. British Gas, as the biggest Gas and Electricity provider in the UK, has dedicated to improve their call centre services for customers. A special phone line has been set up when customers are making enquiries, such as regarding their bills or changing their payment schemes etc.

The current resource planning team is responsible for producing medium and long term forecast for incoming call volumes from 13 weeks to 3 years out. However, due to fast changing market environment and recent business restructuring in British Gas, call volumes in recent years become more volatile. Although the team has some strong opinions on what the true drivers of call volumes are, their correlations have not been proved.

### The problem

The objective of this project tends to identify long term key drivers and evaluate their impacts in driving incoming call volumes through the econometric model building process. This project encounters several problems, including high frequency data modelling, moving and unstable holiday effects, multiple level shifts and structural breaks in the time series with ambiguous starting and ending dates and data limitations. In this case, specific-to-general approach has been used while the regression models are built step by step. Multivariate econometric regressions are finally built and the drivers are identified with elasticity of these drivers are evaluated.



### Results and achievements

The final model results show that calendar and holiday effects, customer numbers and price change effects are the key drivers impacting on call volumes. Both customer numbers and price changes are the most important drivers to the call volumes, given that they have higher elasticity than other variables.

* By a 10% increase in Gas or CC customer numbers, the call volumes are expected to increase by around 3.3-3.5%.
* Call volumes are expected to increase when there is a price change, regardless whether it is a price increase or decrease, by an estimate of 378 extra calls is expected per unit change in price.



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## Forecast Model Development in Supply Chain Management

### Executive summary

This project successfully developed statistical forecasting models for seasonal products at crop sciences. Forecasting accuracy is estimated to increase significantly, leading to inventory savings through better demand planning.



### Client overview

Bayer is a global enterprise in health care, nutrition and high-tech materials, marketing over 5000 products in healthcare, crop science and material science worldwide, with over 300 companies or subsidiaries. The project was conducted with [Bayer Business Services](http://www.bayerbbs.com/) (BBS), the global competence centre of the Bayer Group for IT and business services, including consultancy for forecasting processes and methods and implementation of novel IT solutions in forecasting for procurement & logistics, human resources & management services, and finance & accounting.

### Challenge overview

Planning and coordinating the supply chain in Bayer is vital to ensure timely availability of the products to consumers. Since Bayer offers research-intensive high-margin products, the supply chains of these products should ensure high availability to end customers and avoid costly stock out situations resulting in lost sales, margins or goodwill. Here, forecasting plays a key role as its accuracy drives inventory and hence supply chain efficiency and return on assets. Forecasting hundreds of products with different forms of seasonality and demand uncertainty in both quantity and time horizons require new forecast model development, which conventional approaches could not provide.

### Implementation of the initiative

The Lancaster Centre for Forecasting, based at the Lancaster University Management School, has as its objective, developing new methods and approaches to forecasting focused on improved organisational practices and usage of excellent forecasting tools such as Intelligent Forecaster and SPSS. It has been particularly concerned with evaluating and improving company forecasting systems, funded by the EPSRC and a large number of companies. It has long standing relations to support Bayer group in Germany in improving the supply chain planning process. The project was conducted by a Lancaster University Masters student over a 16 week period.

### The problem

The main theme in the supply chain in Bayer is responsiveness. Customers usually expect instant product availability. But the production cycle being a multi-step and complicated one, is time-consuming. So the gap between demand and supply is bridged via inventories. The nature of the demand being mostly uncertain and subject to frequent variations every year the question of how much inventory is needed is a tricky one. So the company may face potential business loss if the inventory cannot meet the demand. To cope with this demand uncertainty the production relies on a demand forecast and accordingly a safety stock is maintained. But the uncertainty in the seasonal demand pattern in terms of quantity sold and shift in demand months causes high monthly deviations between forecasted and actual values. So the project aims at overcoming the pitfalls of classical time series based approaches by considering uncertainty in quantity and timing. The outcome of the project results should be useful to improve Bayer’s current supply chain planning processes for products with seasonal demand.

### Results and achievements

Results were presented to the client in the form of a detailed report. Key impacts include:

* Developing a new forecast approach that could handle uncertainties in both time and quantity simultaneously
* Assessment of 23 representative products and extension of analysis to > 250 products of different time series components.
* Recommendations for forecast accuracy key performance indicators (KPI)

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## About the Centre

The Lancaster Centre for Forecasting (LCF) is located at the renowned Department of Management Science at Lancaster University, with an outstanding teaching, research and publishing record (highest possible ratings) and a worldwide reputation as an international centre of excellence. Based at one of the most prestigious Management Schools and in the UK’s largest department of Management Science, it offers 15 years of expertise on the complete range of predictive analytics, from demand planning to market modeling, from statistical methods to artificial intelligence and from public sector to corporations in telecommunications, fast moving consumer goods, insurances and manufacturing.

The Lancaster Centre for Forecasting (LCF) leads the field in forecasting research in Europe. Our objectives are to develop applied research with companies, to facilitate knowledge-transfer between academia and business and to establish and disseminate best practices in methods, processes and systems.



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