Int. J. Production Economics 141 (2013) 505–518

Contents lists available at SciVerse ScienceDirect

Int. J. Production Economics

journal homepage: www.elsevier.com/locate/ijpe

Extended revenue forecasting within a service industry

R.I. Whitfield *, A.H.B. Duffy

Leonardo Centre, University of Strathclyde, Department of Design, Manufacture and Engineering Management, 75 Montrose Street, Glasgow, G11XJ, UK

ARTICLE INFO

Article history:
Received 13 January 2011
Accepted 14 November 2011
Available online 22 November 2011

Keywords:
Revenue forecasting
Service industry
Key client
Routine and custom

ABSTRACT

Revenue forecasting is an important topic for management to track business performance and support related decision making processes (e.g. headcount or capital expenditure). It focuses on how a business recognises operating revenue, which can differ from the point at which a sales order is won. Whilst there are many publications detailing forecasting theory, in a business context these largely focus on sales order recognition alone.

This paper describes the development of a revenue forecasting tool appropriate for service provision. The organisation involved in the development of the revenue forecasting tool will remain anonymous for commercial reasons but will be referred to as "Organisation A". The targeted outcome was to extend the forecast window from one month to three months with an error rate of no more than $\pm 10\%$. The tool was required to consolidate supporting data, adopt appropriate analysis/projection techniques and extend the forecast window in a specific and complex business environment.

The resulting tool returned high level results that were aligned to the original targets, and was developed with three components using a combination of projection approaches appropriate to the operating environment. Whilst limited to a specific service industry as a trial, the paper provides a useful reference point for revenue forecasting in complex service businesses and provides a basis for further research opportunities for extended revenue forecasting and business analysis approaches within other service industries.

1. Introduction

Revenue forecasting is an important topic to any management team required to track business performance and support related decision making processes. It focuses on how a business recognises operating revenue, which is not necessarily the point at which a sales order is won. Whilst there are many publications detailing forecasting theory, in a business context they largely focus on sales order recognition alone. Revenue forecasting has little associated academic publication but it is a complex and important field that merits a more detailed investigation.

Revenue in a business context refers to the income received from the sale of goods or services over a set period of time. Revenue is an indicator of organisational asset inflow with the opposite being expenses as an asset outflow. Often referred to as the "top line", revenue sits at the top of the financial income statement, which is a summary of income, out-goings and net profit. Management monitor the top line carefully to ensure that there is sufficient justification to support potential headcount or capital investment decisions. If revenue is trending downwards then this could be a signal to postpone or reduce cost commitments, similarly if revenue is trending upwards in a sustained manner then timely investment to support continued growth could be pertinent. From an investor or shareholder perspective, revenue growth is one of a number of key performance indicators under consideration.

Revenue can be recognised through various methods deemed appropriate to the operating environment. For example, revenue could be taken at time of sale, on billing at completion or by milestone progression. The case study organisation considered in this paper required the recognition of revenue using the milestone progression approach which adds a further layer of complexity into the forecasting tool. The market in which Organisation A operates is complex with respect to forecasting revenue: product mix is high; client base is diverse; and demand predictability is limited but with a fast turnaround expectation.

1.1. Organisational context

Organisation A uses the milestone progression approach to revenue recognition. This is related to the progress from a sales order where revenue is recognised on completion of three milestones: start, end and project report issue. The concept behind

* Corresponding author.
E-mail addresses: ian.whitfield@strath.ac.uk (R.I. Whitfield), alex.duffy@strath.ac.uk (A.H.B. Duffy).

0925-5273/$ - see front matter © 2011 Elsevier B.V. All rights reserved.
doi:10.1016/j.ijpe.2011.11.015

this approach is that delivery could lag significantly behind sales order due to various reasons (e.g. customization, client readiness, bespoke materials or development lead times).

The implications of under-forecasting could include resource exposure, quality and service risk, whereas over-forecasting can be equally damaging through excess resource, cost and eroded margins. At Organisation A, revenue forecasting is currently limited to a one month assessment based on limited systems, process and data availability. The challenge is to develop a tool that can consolidate supporting data, adopt appropriate analysis/projection techniques and provide an improved level of predictability in a specific and complex business environment. For the development of the forecasting tool, the solution focused on the UK operation, although this could be extended.

2. Forecasting approaches

As the specific field of "revenue forecasting" is limited in terms of academic publications, this section considers underlying elements of the required tool and associated concepts to build up an appropriate knowledge base. Through an analysis of a broad range of publications, the expectation is that we will be able to critically evaluate options that could ultimately be deemed appropriate for the tool development.

Forecasting can be applied to any situation where there is a requirement to predict the outcome of current or future activity. In a business context this could be applied to a range of scenarios such as demand, capacity or inventory management. Slack et al. (2004) noted that even though forecasts are prone to error, they are necessary to support the management decision making process. Similarly Smith et al. (1996) reported that from a survey of 175 companies, 92% of respondents indicated that forecasting was important for their company's success. Whilst some managers complain that the nature of their business makes it impossible to forecast, Wallace and Stahl (2008) suggested that every business can forecast, it is just that the level of forecast accuracy that can vary significantly between business environments.

Smith et al. (1996) developed an eight point forecasting guide that included: horizon; accuracy; elasticity of demand; and aggregate versus disaggregate principles. Similarly Lin and Hatcher (1993) suggested a more detailed six section forecast framework. Whilst there were commonalities, the framework also considered intentions for data output including: pattern/trend identifying, outlier handling, adjustments, diagnosis and risk analysis. Investing significant time and effort in forecasting would be futile if there was a lack of confidence in the tool to drive actions and decision making.

A range of forecasting techniques are discussed within the following sections. Some of these techniques are seen as more applicable depending on the nature of the data or the operating environment. Broadly speaking forecasting techniques can be classified into two groups: quantitative and qualitative forecasting.

2.1. Quantitative forecasting models

Texts such as "Forecasting" (Makridakis et al., 1998) can provide a thorough reference for all aspects of business forecasting from basic tools to ARIMA, software packages and implementation guidance. For non-specialists, a good starting point would be Operations/Demand Management texts that generally provide an explanation of the basic forecast techniques. Brandon-Jones and Slack (2008), demonstrate Time Series analysis as a method for examining past behaviour over time taking into account reasons for variation in the trend in order to use the analysis to forecast future trends. A top level explanation of basic time series techniques and their application could be summarised as follows (Slack et al., 2004; Wallace and Stahl, 2008): Exponential Smoothed Forecast; Linear Regression—short-term projection using best fit line for less regular data; Mean Absolute Deviation—short-term projection using most recent, regular data; Moving Average—short-medium term projection, up to three time period datasets; and, Weighted Moving Average—weighted to highest influencing datasets.

The selection of appropriate forecasting techniques is critical to the success of any new initiative. Mahmoud and Pegels (1990) considered an approach for selecting forecasting models, and suggested considering several factors: the managerial problem, which the forecast is required to solve; the forecast lead time; the data availability and structure; the accuracy of the forecasting method; costs involved in using the method; and miscellaneous factors (e.g. managerial understanding/forecast budget).

Factors such as cost/budget, data availability and nature of the problem all require particular attention when embarking on a forecasting initiative. The organisation needs to consider if techniques analyse top level data, product family at aggregate level or product line at detail level (or a combination), as well as considering whether analysis is aimed at sales forecast, order consumption rates, revenue trending, or a selection/combination of data.

Mahmoud and Pegels (1990) concluded from their findings that for short term forecasting, some simple techniques such as Linear or Single Exponential Smoothing demonstrated considerable superiority over slightly more complicated techniques such as Census II or Box Jenkins. (Slack et al. (2004) cited a similar finding that for short term forecasting (up to three months), simple time series methods could often make more accurate forecasts than more theoretically elegant and elaborate approaches used in econometric forecasting.

2.2. Qualitative forecasting models

An alternative or complimentary approach to formal quantitative analysis would be qualitative modelling. Slack et al. (2004) suggest the following qualitative techniques: Delphi Method—questionnaire issued to experts, followed by forecast refinement and review to finalise forecast; Panel Approach—focus group of experts discuss outlook and agree by consensus; Scenario Planning—assessment of various scenarios which potentially looks for a range of options rather than for consensus.

Chambers and Mullick (1993) identified the same techniques as preferred qualitative approaches, although described a variation to Scenario Planning in Cross Impact analysis. This approach although similar, involves analysing every single event on every other event to convert qualitative information into a quantitative forecast. Chambers and Mullic commented that the Delphi Method was developed from the Panel Approach, which was found to be problematic based on group dynamics. However it was identified that the Delphi Method was most successful in strategic forecasting, particularly when considering technological change, industry change or change in customer preference. Similarly Loo (2002) discussed Delphi in context of changing policing strategies (i.e. long term forecasting). Even though Loo identified some benefits of using Delphi, it was recommended that an "across method" triangulation would help validate results more than a single approach.

Mathews and Diamantopoulos (1993) suggested that many formal models are combined with judgemental input in order to arrive at the final forecast, which is accepted by management for decision making processes. Sanders and Ritzman (1993) added that surveys of business managers suggested that judgemental forecasting approaches dominate in business practise. Smith et al. (1996) found in a survey of forecasting techniques that studies indicated