

Report for the Chartered Quality Institute  
and Chartered Management Institute

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# The contribution of quality management to the UK economy

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This report was written and researched by the  
Centre for Economics and Business Research (Cebr)

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## Brief introduction

This study by the Centre for Economics and Business Research (Cebr) concludes that, not only has the effective application of quality management (QM) procedures already contributed to past UK business and economic successes and that it will continue to do so in the future, but that it could well provide an important foundation on which future business and institutional success could be built. Such success is vital to the task of returning the UK to positive economic growth.

At the request of the Chartered Quality Institute (CQI) the Cebr has investigated the economic impact of QM programmes, through its effects on the productivity and success of organisations in the private, public and voluntary sectors.

The fruits of our lengthy investigation are contained within the pages of this report, and summarised in this preamble. Our investigations were carried out in accordance with the study's twin research aims to, **firstly**, demonstrate and quantify the extent to which more effective, intensive and longer-term use of QM systems and techniques create more productive and successful organisations and **secondly**, to show how this translates into positive effects on headline economic indicators.

## Key conclusions of the report

Overall, Cebr's investigations of QM in the UK economy point to three broad conclusions:

- i. Insofar as they have been implemented by organisations in the different sectors of the economy, QM systems have already contributed substantially to the success of those organisations, judged against a wide array of metrics. Return on investment (RoI) data support this conclusion, indicating that businesses can typically expect to make more from their QM systems than they spend implementing them.
- ii. Via their impact on organisations' outcomes, QM systems have, in aggregate, proven themselves important contributors to the health of the UK macroeconomy. In other words, QM programmes have already improved UK macroeconomic outcomes significantly.
- iii. If QM programmes were instituted more widely by organisations in all sectors of the economy, these desirable effects would become even more pronounced, to the benefit of both the organisations individually and to the UK economy as a whole. RoI data, estimated from a series of in-depth interviews, support this conclusion. Across a number of interview respondents, the data indicated an average Revenue RoI of 6:1, i.e. for every £1 spent on a QM programme, revenues were increased by £6. They also indicated an average Cost RoI of 16:1. This implies that for every £1 spent on a QM programme, costs were reduced by £16. One case

study respondent's data yielded a Profit RoI of 3:1, implying that for every £1 spent on QM, profits increased by £3. Finally, one interview respondent, a quality excellence body, reported that across 830 business services firms, investing in QM programmes had reduced costs by £18 for every £1 spent. These impressive RoI findings indicate that if QM programmes were instituted more widely, businesses would stand to benefit from net reductions in costs and net increases in revenues and profits.

These three conclusions are the final product of the combination of primary and secondary data inputs provided through case studies (based on in-depth interviews), a survey of 120 organisations, and a review of the literature on business and economic effects of QM.

These three sources were generally coherent with each other. Also, because they were independent their coherency indicates that the information they yielded is correct. That is, it is unlikely that three independent data sources would all be incorrect in similar ways. This means that Cebr has every confidence in the three broad conclusions stated above.

## Synopsis of the findings

The literature review evidence suggests that effective QM programmes can contribute to increases in share price, profit, revenue and customer retention, as well as employee, customer and user satisfaction. There was also a significant body of evidence indicating that QM programmes, particularly Lean programmes, reduce costs. This is especially relevant to public sector organisations<sup>1</sup>.

The evidence reveals that QM mechanisms mitigate the cost of identifying and rectifying problems during or after production, while raising those expenditures that are focussed on stopping problems before they occur. This cost rebalancing was found to be associated with a reduction in overall costs.

The evidence also supports the contention that QM programmes often become effective with a lag, in that their most substantial impacts on an organisation's economic outcomes can come several years after implementation<sup>2</sup>.

We also find, from the literature review evidence under scrutiny, that a precondition of a QM programme's success is senior management's active commitment to the programme in the first place.

Responses to the survey questionnaire indicate that QM mechanisms were utilised primarily by businesses to control

cost, and maintain or improve customer retention rates. QM programmes were also often found to be useful in justifying premium pricing of goods and services. The survey results generally cohere with the literature.

The case studies also tend to cohere with the literature when examining QM's effects on outcomes for organisations in given sectors. For instance, case study respondents from all sectors often identified that their organisation's QM programme had helped to control costs and/or raise customer retention or satisfaction. However, the literature and case studies do not always agree. For example, responses to the case study questions in the legal services industry suggest that QM mechanisms become effective comparatively quickly in that sector, more rapidly in fact than in other types of commerce or industry.

### Estimated quantitative impacts on the economy

Using inputs drawn from the aforementioned sources, Cebr's bespoke economic model fulfils the second aim of the report by formulating estimates of QM's impacts on headline UK economic indicators.

The model formulates estimates for each year of the 2009-13 study period, and for an average or typical year of that period. As the completed year with the timeliest data, the model's headlined estimates focus, consequently, on 2011. They are:

#### i. GDP

In 2011, Cebr estimates QM procedures contributed £86bn to Gross Domestic Product (GDP) in real terms (based on 2009 pounds sterling).<sup>3</sup> In other words, we estimate UK GDP would have been 6.02% lower than it really was in 2011, had no QM procedures been in place in the economy.

Furthermore, if QM programmes had been rolled out as fully as possible throughout the UK economy then 2011 GDP might have been £46bn higher (in terms of real 2009 pounds). This estimate implies that, in 2011, had QM systems been implemented throughout the economy, GDP would have been 3.37% higher.

#### ii. EMPLOYMENT

In 2011, Cebr estimates that QM procedures caused UK economy-wide employment to be 1.43 million higher than it would otherwise have been. This means our economic model estimates that UK employment would have been 4.94% lower than it actually was in 2011, had no organisation in any sector of the economy had any QM procedures in place that year.

Moreover, if QM programmes had been instituted as fully as possible in all sectors of the UK economy, employment in 2011 could have been higher than it actually was by 455,000 jobs. This represents a forgone potential increase in employment of 1.57%.

#### iii. TAX RECEIPTS TO THE EXCHEQUER

In 2011, QM procedures are estimated to have contributed a minimum of £8.4bn (in terms of real 2009 pounds) to the Exchequer<sup>4</sup>.

What is more, if QM programmes had been rolled out as fully as possible, in 2011 the Exchequer's net tax takings would have been nearly double that and might have been £8bn (in terms of real 2009 pounds) higher than they actually were.

These estimates are the outputs of a spreadsheet-based economic model which formulates estimates of QM's effects on headline UK macroeconomic indicators by utilising the inputs provided by the literature review, case studies and survey.

The cause-and-effect assumption upon which the model was predicated – that QM can improve the efficiency of individual organisations' productive processes and that this can improve headline UK economic indicators – was, in turn, premised upon widespread conclusions derived from the literature review. As such, Cebr is satisfied that this assumption is sufficiently robust for the purposes of this investigation.

### Overview of the report

In order to garner the research materials needed for such a report, Cebr gathered primary evidence from three main sources. They were: (i) an exhaustive global and academic literature review; (ii) an extensive survey of 120 pertinent organisations; and (iii) a quantity of relevant original high-level case studies attained through interviews.

A working definition of quality management (which accords with the CQI's most up-to-date interpretation) is adopted at the beginning of the literature review. This working definition then applies thematically throughout the report as a whole.

The study begins with an overview of the historical development of QM. The historical overview itself commences with the beginnings of modern quality management in armaments' production during the First World War, when specialised quality managers first began to intercept defective items and had them scrapped or reworked post-production. The subsequent development of QM is then discussed through the prism of the theorists contributing most to its systems and practice development, notably Shewhart, Deming and Juran. The discussion focuses on their application of statistical methods to quality, and the broader management and organisational principles they developed and refined.

Then, in light of US and British concerns over their international competitiveness in the 1970s and 1980s, and building on growing industrial and political opinion that the promotion of QM could supply a desirable additional competitiveness, the introduction discusses the wholesale adoption of new QM techniques, such as Kansei Engineering, Continuous Improvement and Lean. The historical overview finishes by discussing the development of QM certificates – such as ISO 9001 and PQASSO – and the benefit that organisations derive from them.

The second part of the introduction explains that the report adopts a diverse set of methodologies: (i) a literature review; (ii) case studies; (iii) a survey of 120 organisations; and (iv) the formulation of a new bespoke economic model by Cebr, the purpose of which is to estimate the impacts of QM on headline UK macroeconomic indicators.

The first three methodological stages are primarily focussed on achieving the report's first aim, and constitute primary sources of data in their own right for use in the fourth stage.

The final methodology, Cebr's new economic model of the impact of QM, uses the primary data inputs provided by the first three methodology stages to estimate the impact of QM mechanisms on headline UK macroeconomic indicators, thus achieving the report's second aim.

The use of these different and independent methodologies makes the report robust, in that it is not solely reliant upon any single data input or methodological approach. Discussion points throughout the report note that the primary data sources are coherent with each other and are mutually independent, further increasing Cebr's confidence in the robustness of the report's findings.

The literature review section of the report discusses the real-world evidence of how QM systems causally affect the outcomes of private sector businesses, and of public and voluntary sector organisations. Effects on the following outcomes are examined: stock prices, profits, revenues, customer and employee satisfaction, costs, customer retention and organisational culture. The literature review finds that QM mechanisms tend to improve all these metrics, although effects often occur with a lag.

The main body of the literature review highlights that any one QM programme can affect multiple outcomes both directly and indirectly, drawing linkages between QM's effects on these different outcomes.

In the conclusion of the literature review, the different strands of the discussion are brought together in two ways:

Firstly, in relation to the analysis of a 1982 UK Government White Paper on QM's potential contribution to the UK macroeconomy in the current economic context, Cebr concludes that, taken together, the widespread implementation of QM procedures can: (i) improve the UK's international competitiveness; and (ii) boost its rate of economic growth.

Secondly, the literature's discussions which link any one QM programme to changes in several outcomes are tied together in the framework provided by Deming. In *Out of the Crisis* (1982) Deming reached the crucial insight that any one QM programme could bring about a "chain reaction," by which the programme directly and indirectly affects several business or organisational outcomes. This insight is echoed throughout the literature.

Each subsequent section of the report focuses on a different method of analysis. The analyses in these sections build logically on the results attained by the preceding sections. The overall structure of the report is ultimately a product of the initial literature review, because:

- i. The working definition of QM which the literature review adopts defines the limits of the discussions and analyses which take place in the remainder of the report.
- ii. The case studies and survey section are structured in such a manner that their findings can be easily compared to those of the literature review. This enabled Cebr to examine how coherent the three primary data sources are with each other and thus ascertain, to a certain extent, how much confidence can be placed in the report's overall findings. Cebr found a high degree of coherency between the three independent primary data sources, lending a high level of confidence to the report's final conclusions.

After the literature review, a series of 18 case studies is presented. A summary of the structure of the case studies and an explanation of how they relate to the rest of the report is then given. The case study respondents answered questions as to how far QM in their organisation had increased revenues, customer retention and employee satisfaction. They also discussed how far their

organisation's QM programme had reduced costs.

The case study results are summarised in section 1.3. The case studies are grouped into sectors (such as business services, manufacturing, public sector, etc) to enable their sectoral results to be compared to the literature's outline predictions and insights. This enables Cebr to evaluate how typical of the literature each of the specific case study-grouped sectors are.

The grouped sector structure of the case studies also enables Cebr to highlight interesting points of departure, identifying areas where the QM experiences of specific sectors do not entirely agree with the literature's predictions.

These points of departure suggest that, regarding a few specific outcome metrics, QM programmes impact organisations in a few specific sectors in a manner which is different to that which is predicted by the literature. For example, QM systems seem to achieve their effects more rapidly in the legal services sector than the literature would predict. Overall, however, the case study responses agree with the literature's predictions across different sectors.

Speaking directly to business leaders, where a case study respondent provided sufficient data, the RoI of his or her business's QM programme was estimated. These RoI estimates consistently indicated that businesses achieve gross monetary benefits, in terms of reduced costs or increased revenues and profits, which far outweigh the cost of their QM programmes. Across those case study respondent businesses which provided sufficient information, the data indicated an average Cost RoI of 16:1. This implies that for every £1 spent on a QM programme, costs were reduced by £16. The data also indicated an average Revenue RoI of 6:1, ie for every £1 spent on a QM programme, revenues were increased by £6.<sup>5</sup> All case study respondents who provided sufficient data were found to have derived positive RoI benefits from their QM programmes. The consistency of these RoI findings suggests that businesses will generally gain more from their QM programmes than they spend on them.

A reassuringly high degree of coherency between the literature review and case studies began to emerge and, indeed, in the final analysis, the findings of the literature review, case studies and survey (discussed below) were predominantly found to be logically coherent and consequently consistent with each other. The report then surveys 120 organisations, asking questions about the effects of QM on their outcomes. The survey data yield two principal findings:

1. QM programmes often induce significant cost savings for businesses.
2. QM programmes are perceived to be a key driver of wider business success. Survey respondents reported their belief that the successful implementation of QM programmes is particularly important when working to retain customers, and justify price premiums on goods and services.

The survey findings are presented so that they can be compared to the literature review's findings. The overall picture is one of agreement between the literature and survey findings. The survey's first finding is supported by several papers, which found that the implementation of QM programmes, particularly Lean programmes, drives down costs across institutions in all sectors. The second finding is given support by a large number

of the papers under review. These papers find that a variety of QM mechanisms have improved customer retention rates and revenues, as well as overall financial performance. Because price premia are a key driver of healthy revenues, these papers support the second case study finding.

In summary, the findings of the literature review, case studies and survey were predominantly found to be coherent with each other. Because these sources were independent, this coherency provides a strong indication that the data provided by the sources are correct. It is extremely unlikely that three independent primary data sources would all be incorrect in the same way.

As a consequence, Cebr has a high degree of confidence in the report's findings as they relate to QM's efficacy in creating more productive and successful organisations.

#### References

1. See *Cohen and Brand (1993) and the Scottish Executive (2006)* for discussions on Lean programmes' particular effectiveness in reducing public sector organisations' costs.
2. Empirical investigations tend to agree that QM programmes become effective with a lag, but disagree as to the length of this lag. For example, *Hannah (2011)* finds that ISO 9001-certified businesses' asset returns become noticeably higher than those of comparable businesses about two years after certification. By contrast, *Hendricks and Singhal (2001)* find that QM programmes tend to become effective with a lag of up to five years.
3. The model yields' estimates for each year from 2009-13 and all other estimates are given in terms of real 2009 pounds; 2009 is the first year of the model. Presenting the estimates in this manner strips out the effects of inflation, which reduces the real buying-power of a pound in each subsequent year. Giving the model's annual estimates in terms of 2009 pounds makes the estimates for each year directly comparable. Achieving direct comparability in this manner – ie by presenting estimates in terms of currency in the first year of the model – is standard practice in multi-year empirical models.
4. Taxes on incomes are not included in these estimates.
5. Only one respondent provided data which enabled Cebr to estimate a Profit RoI. Hence, no average Profit RoI was estimated across different businesses. The Profit RoI was found to be 3:1, implying that for every £1 spent on QM, profits increased by £3.

# 1 INTRODUCTION AND METHODOLOGICAL OVERVIEW

## 1.1 Overview and aims of the report

This report, commissioned by the Chartered Quality Institute (CQI), details Cebr's analysis of quality management's (QM) contribution to the UK economy. This introduction provides context for the rest of the report by summarising the evolution of QM since its inception during the First World War. It then describes the investigative methods used and the report's structure. The structure is such that the analysis of each section builds logically on the preceding sections.

The dual objectives of the research were to demonstrate and quantify the extent to which more effective, intensive and longer-term use of QM systems and techniques: (i) creates more productive and successful organisations by delivering demonstrable RoI value; and (ii) affects headline UK economic indicators. These aims are complementary but distinct, as are the methods used to achieve them. The three investigative methods used in the report - a literature review, case studies and a survey of 120 organisations - have focussed on achieving the first aim. We then used a bespoke economic model to gather the evidence from the three investigative streams as inputs for the purpose of estimating the effects of QM on headline UK economic indicators.

This report adopts the CQI's definition of QM as its own working definition of QM. A short version of the definition is now given to contextualise the discussion in this introduction. The full version of the definition is given and discussed at the start of sub-section 2.2. Under the working definition, QM techniques: (i) are applied across entire organisations and focus on meeting customer requirements; (ii) facilitate the planning of product lifecycles and delivery; and (iii) quantify all elements of productive processes to drive continual improvements in quality. This working definition of QM ensures that only those organisational practices that have a *prima facie* right to be called QM are discussed in this report.

## 1.2 A history of quality management

The development of modern QM has been driven by the innovations and ideas of notable individuals. These have altered the way in which entire businesses manage quality, and have led to radical changes in the business culture and practices of entire countries. In particular, they have promoted the role of management and the active involvement of staff in driving quality improvements. Modern QM began modestly during the First World War, when armaments were sent back for fixing or discarded if they did not meet quality standards after they had been produced. By the mid-1920s, QM systems had shifted their focus to analysing and altering productive processes, to stop defects before they became apparent in finished products. This reduced the need for post-production reworking or scrapping.

These new mechanisms were dependent on a statistical analysis of processes, but QM has since evolved to include a holistic toolkit that is applied in all sectors of the economy. Modern-day QM mechanisms typically employ statistical process control mechanisms, and emphasise management leadership and employee commitment to quality improvements.

Noticing that poor-quality military equipment was contributing to casualties, the belligerent governments instituted QM procedures in their armaments factories. While these procedures were rudimentary by today's standards, it is accepted that modern QM systems materialised during the First World War. The procedures created a number of quality inspectors who focussed on selecting which armaments did not meet required standards after they had been produced. These armaments were then reworked or scrapped.<sup>6</sup> QM processes during the First World War were simpler than those which came after because they focussed primarily on managing quality after production, as opposed to during it.

More advanced QM mechanisms came about in the mid-1920s when a statistician, Dr Walter Shewhart, formulated the first-ever statistical 'control chart' while working in manufacturing at the Western Electric Company's Bell Laboratories in the US. The contribution of these charts was to quantify the extent to which variation in the outputs of a productive process was caused by the production process itself, as opposed to being caused by factors outside the specified parameters of the process.

This gave the charts two principal functions: (i) they could be used to reduce variation in output quality which resulted from factors outside the productive process; and (ii) they could inform changes to productive processes in order to alter the quality of outputs. This innovation was the first attempt to determine how productive processes affected the quality of outputs, and to tie the quality of outputs closely to productive processes. Previous attempts to control output quality (during the First World War) focussed largely on rejecting units post-production. Shewhart's unique innovation was to use statistics to analyse and alter productive processes with the aim of stopping defects before they occurred in the first place.

During the inter-war and Second World War periods, Shewhart's ideas were built on by Deming, Dodge and Roming. While all of their contributions were important, we focus on Deming's pre-eminent role. Deming realised that Shewhart's methods could be applied outside of manufacturing and provided four principal innovations:

1. He explained that statistical sampling methods could be used to inform QM processes and regulate the quality of

outcomes.<sup>7</sup> These techniques were applied by the United States Government during the Second World War.

2. He undertook a quantitative analysis of organisational structures to pinpoint the causes of quality failures. He found that systemic weaknesses in productive systems and poor management processes had caused the majority of quality failures – that is, he found that design flaws inherent in the productive processes themselves often necessitated a disappointingly high proportion of defective units of output. Deming also found that poor management had a similar effect.
3. Based on these findings, he suggested that the onus was on management to remain committed to the rectification of process failures, and to engender an environment in which workers – in whom he advocated vesting a key role in the QM system – could flag up and rectify deficient processes.
4. The Plan-Do-Check-Act cycle. This is an iterative process in which an organisation: (i) Plans, by establishing the processes necessary to achieve its specified quality aims; (ii) Does, by carrying out the process and producing the finished goods or service while making sure to collect quantitative data on the process and the quality of its outputs; (iii) Checks, through analysis of the data collected, identifying disjoints between the output quality desired in the planning phase and that which was achieved in the doing phase; and (iv) Acts, by augmenting its processes in line with the data analysis to move the quality of outputs closer to their desired level.<sup>8</sup>

During the post-WWII period, Deming exerted a significant influence on Japanese QM culture. Japanese industrialists were keen to use his ideas to re-grow their economy following defeat by the Allies. The application of Deming's ideas contributed to improvements in the quality of Japanese goods. Deming's ideas were encapsulated in his seminal work, *Out of the Crisis* and the Deming Prize was established in Japan in recognition of his unique contribution to QM.

Following Deming, Juran (1951) made significant contributions to the theory and practice of QM.<sup>9</sup> He highlighted that the quality of a product or service should take account of the degree to which it satisfies customer expectations, as opposed to purely capturing the degree to which it satisfied technical specifications. He pioneered the 'Costs of Poor Quality' approach which allowed organisations to quantify the cost of quality failures, making QM achievements directly comparable across organisations. Like Deming, Juran believed that workers had a key role to play in continuously driving quality improvements. Juran also exerted significant influence on Japanese QM culture.

By the 1970s, the high quality of Japanese goods was beginning to weigh down on markets in the USA, which were producing comparatively low quality products. It was in this context that Crosby wrote *Quality is Free* in 1979, emphasising the notion of Zero Defects.

Crosby maintained that it is possible to design and implement processes which do not produce any defective outputs. He argued that this should be the aim of QM processes, maintaining that allowing some positive proportion of goods or services produced to be defective actually encourages defects. He also argued that the benefits of a robust QM programme almost

always outweigh the costs of its implementation, hence the title of his book, *Quality is Free*. Crosby suggested that producing some positive number of defective units did not need to be an inherent feature of any given productive process, maintaining that it is possible to reduce defective units to nil, whilst still meeting product specification and customer requirements. Crosby's ideas contributed to attempts by businesses in the USA to address the issue of strong quality competition from Japanese businesses. Crosby's main practical achievement was to realise substantial reductions in defect rates whilst employed as the quality control manager of the Pershing Missile Programme.<sup>10</sup>

The 1982 UK Parliament White Paper entitled 'Standards, Quality and International Competitiveness' noted that "success in world markets increasingly depends on a supplier's ability to satisfy customers on... quality." Hence, the White Paper suggested that the widespread implementation of QM systems by UK firms will "strengthen its [the UK's] international competitiveness." By increasing the total value, quality and quantity of exports, the White Paper anticipated that the adoption of quality management techniques would boost UK economic growth.

Since then, QM has continued to develop and its techniques are now applied widely by private sector manufacturing and services businesses and by public and third sector organisations. Modern QM techniques include:

- i. *Kansei engineering*: this technique aims to incorporate the emotional and psychological requirements of the customer into the features of a product or service. As such, Kansei engineering uses statistical techniques to enable customers' psychological requirements to inform product parameters. Statistical techniques are also used to refine productive processes so that deviations from those parameters are minimised.
- ii. *Taguchi methods*: a set of QM techniques focussing on product and service design quality. The rationale for these techniques was the belief that it is more cost-effective to design products and services effectively than to correct defects during or after the production process.
- iii. *Six Sigma*: this technique was developed by Motorola in 1986 and aims for the complete elimination of the causes of defects and product variation through the application of statistical methods. Six Sigma techniques have four principal characteristics: (i) they focus on quantifying the impact that process improvements have of financial returns; (ii) they emphasise the necessity of active leadership by senior management to drive forward process improvements; (iii) they seek to integrate human elements – eg workplace culture and customer relations – and process elements – eg process management and statistical analysis – to achieve process improvements; and (iv) they use a defined set of tools to improve processes in a sequential and consistent manner.<sup>11</sup> From its beginnings in the manufacturing sector, Six Sigma is now applied widely in private sector services, and in the public and third sectors.
- iv. *Continuous Improvement*: this set of techniques emphasises an employee-led gradual improvement in productive techniques. This purports to deliver three principal benefits: (i) ongoing incremental changes are unlikely to disrupt product or service production to the same extent as larger (such as

R&D-based) changes; (ii) they tend to be less expensive than changes arising from specific (such as R&D or external consultancy-based) QM initiatives, because such changes flow from the day-to-day work of employees; and (iii) continuous improvement mechanisms might identify improvements which other QM techniques could have overlooked because employees, being closer to the production process, might identify improvements which management could miss, and because the process is employee-led.<sup>12</sup>

- v. Lean: this is a comprehensive set of QM techniques aimed at eliminating wasteful or inefficient steps in the production process of a good or service. The process also focuses on increasing the flow and synergies between steps, thereby reducing their overall costs. Toyota was the first proponent of Lean, defining the approach as having five principal components: (i) specification of the value desired; (ii) identification of the value stream and challenging the wasteful steps; (iii) make the product flow continuously; (iv) introducing pull between all steps; and (v) continuous falls in the time and information needed to serve the customers.<sup>13</sup> Since then, authors have identified two principal aims of Lean, now accepted as conventional wisdom, as being: (i) to deliver consistent value to the customer while reducing the costs of productive processes, thereby raising profits; and (ii) to increase the final value the customer receives.<sup>14</sup>

Finally, in recognition of its importance, a large body of QM certificates have evolved. In general, these certificates enable organisations and individuals to demonstrate that they have achieved a level of proficiency in a given set of quality management techniques. Interestingly, several case study interviewees noted that the process of working to attain these certificates improved their QM procedures (see the case studies in section 4.) Three of the most widely applied certificates are now described here. These certificates were chosen, not as an exhaustive description of the current QM certification environment, but rather to capture some of what is a wide spectrum of available QM certification techniques in terms of the sectors they apply to, their requirements, and whether they are awarded to individuals or organisations:

- i. The ISO 9001 certificate is applicable to organisations in the private, public and voluntary sectors. ISO 9001 is awarded to an organisation, or some part of an organisation, by an independent certification body<sup>15</sup>, provided: (i) its quality policy is actively followed by all employees and is driven by senior management; (ii) its QM decisions are based on an analysis of relevant data and the QM system is subject to regular review; (iii) it communicates with customers, ascertaining their requirements via formal communication procedures, and its QM systems are informed by these communications; (iv) its QM policy is formally stated and linked to customer requirements; (v) product and service development is rigorously planned and linked to QM procedures; and (vi) the organisation regularly reviews its own performance via a system of internal audits, thereby alleviating past and potential future QM problems. The certificate also requires that organisations document their quality policies, QM procedures, QM verification and improvement procedures, audit procedures and control procedures. For ISO 9001 to be awarded to an organisation, or some part of it, the certification body must be satisfied that it has achieved and maintained a high standard in all of the above areas.<sup>16</sup>
- ii. The Six Sigma certificate has its origins at Motorola in the 1970s, resulting from senior executive, Art Sundry's criticisms of the business' quality procedures and standards. The term Six Sigma is derived from a statistical condition under which almost all units produced meet specifications – emphasising a focus on solving quality problems through data analysis. The Six Sigma certificate can be awarded to individuals in all sectors according to their degree of proficiency with Six Sigma procedures and standards. For example, indicating increasing degrees of competency, certificated individuals are awarded the following titles: 'Green Belts', 'Black Belts', 'Master Black Belts' and 'Champions'. These individuals drive the implementation of a Six Sigma programme within an organisation. Six Sigma requires: (i) a drive to reduce process variability; (ii) the measurement and improvement of the characteristics of productive processes; (iii) senior management that actively drives forward improvements; (iv) the attainment of quantifiable financial returns for any Six Sigma project; and (v) a commitment to making quality decisions based on data analysis.<sup>17</sup> Many different bodies award Six Sigma certification, and certification requirements are subject to some variability depending on the awarding body.<sup>18</sup> For instance, the American Society for Quality requires Black Belt applicants to demonstrate substantial practical experience in applying Six Sigma and to pass an exam.<sup>19</sup> Other organisations, including Air Academy Associates, Six Sigma Qualtec and Aveta Business Institute, also offer certification.<sup>20</sup> Just like Motorola in the 1970s, many organisations certify their employees using procedures which are (at least partially) internal, while others outsource part of the certification process. For instance, the International Quality Federation provides Six Sigma exams for organisations to use in their internal certification procedures.
- iii. The PQASSO certificate is widely applied in the voluntary sector.<sup>21</sup> Under the PQASSO framework, a voluntary sector organisation may be awarded a Level 1, 2 or 3 certificate, indicating basic proficiency, advanced proficiency and outstanding performance, respectively, in 12 aspects of quality. These are planning, governance, leadership and management, user-centred service, managing people, learning and development, managing money, managing resources, communications and promotion, working with others, monitoring and evaluation, and attaining results. To reach a particular level in a given aspect of quality, an organisation must meet the relevant indicators for that level and plan for necessary improvements. To attain PQASSO certification, a voluntary sector organisation undertakes a self-assessment exercise which must then be independently verified by "PQASSO Quality Mark peer reviewers – members of the voluntary and community sector who are specially trained and supported by Charities Evaluation Services to carry out reviews of organisations against the PQASSO standards".<sup>22</sup> The external assessment is comprehensive, involving a review of documentation, interviews with staff and board members and evidence gathering.<sup>23</sup>

From simple beginnings in the First World War armaments industry, and then as a purely statistical control methodology in private sector manufacturing in the 1920s, QM has gradually expanded to influence management and worker practices and culture. QM is now applied widely in all areas of the private, public and third sectors and there has occurred a proliferation of QM techniques and certifications. Even at the level of entire

nations, the effects of QM cannot be understated. The embrace of QM was a key factor in Japan's post-war economic recovery and, in response to the dynamism QM lent to Japanese manufacturers relative to their own, Western economies saw little choice but to adopt QM practices and philosophies. For the UK, this report aims to present evidence demonstrating the extent to which the adoption of QM has: (i) improved public and private sector organisations' outcomes; and (ii) has impacted on headline economy-wide indicators.

### 1.3 Structure of the report and overview of study methods

In order to achieve these objectives rigorously, the study adopted a diverse set of methodologies: a literature review; case studies; a survey of 120 organisations; and the formulation of a bespoke economic model to estimate the effects of QM on headline UK economic indicators. The use of several methodologies means that the report's results are not wholly reliant on any single method of analysis, making them more robust. The literature review, case studies and survey focus largely (although not exclusively) on achieving the report's first objective: analysing the extent to which QM creates more productive and successful organisations. The model furthers the report's second aim by providing estimates of QM's impact on headline UK economic indicators.

Each section of the report focuses on a different method of analysis. The analysis in each subsequent section of the report builds logically on the results presented in the preceding sections, and the overall structure of the report is ultimately a product of the initial literature review.

The literature review adopts a working definition of QM (which applies to the literature review and to the report as a whole) before discussing the findings of the literature review as to how QM has affected different outcomes. These outcomes cover: (i) stock prices, (ii) customer and user retention and satisfaction, and employee and volunteer satisfaction; (iii) costs; (iv) financial performance and profits; and (v) organisational culture. Using this outcomes-based structure, the literature review discusses how the application of QM techniques has affected these outcomes in the public, private and voluntary sectors. Linkages between QM's effect on the different outcomes are discussed throughout, and general conclusions are drawn at the end of the literature review.

The remainder of the report builds on the literature review, using it to inform the structure of the case studies and survey. The results of the literature review are compared to those of the case studies and survey, to determine the extent to which the three different elements of the evidence base are consistent. Finally, Cebr's bespoke economic model builds on these three elements, using the quantitative data they provide as inputs in order to estimate the UK economy-wide impact of QM. The model is not an evidence source in its own right. Rather, it is a tool of analysis which uses the evidence base provided by the literature review, case studies and survey to estimate the effect of QM on headline UK economic indicators.<sup>24</sup>

Following the literature review, the report moves on to consider the case studies that were formulated based on a process of in-depth interviews that formed part of the research brief. Following the objectives of the literature review, these case studies seek to determine how QM techniques have affected the outcomes of different organisations. The case study responses will be linked to the literature by examining the extent to which they agree with it.

This allows Cebr to investigate how far real-world organisations' experiences cohere with the literature's predictions. The case studies will be grouped by sector and the extent to which each sector's case study results are consistent with the literature will be discussed.

In cases where the case study respondent has provided sufficient information, Cebr will endeavour to estimate his or her organisation's RoI from QM.<sup>25</sup> In all cases, Cebr found that respondents' companies had received significant RoI benefits from their QM programmes. They gained more in terms of increased profits, increased revenues and reduced costs than they spent on their QM systems. The consistency of these findings means it is reasonable to infer that, as a general rule, private sector companies can expect a positive RoI from their QM programmes, ie they can anticipate making more from their QM programmes than they spend implementing them.<sup>26</sup>

The results of a survey of 120 organisations will then be presented. These results show QM's impact on the survey respondents' organisations' outcomes, naturally building on the literature review and case studies which analysed the same issue. The survey results will be compared with our findings from the literature review and the case studies, thus providing another measure of how far real-world organisations' experiences agree with our findings from these processes. Broadly, the literature and survey results are mutually supportive of each other. However, there is one point picked up by the survey which the literature does not address, which is, that businesses may be underinvesting and under-incentivising QM.

The following are details of the construction of Cebr's bespoke economic model, which seeks to analyse QM's effect on four key UK economic indicators: GDP; the efficiency of sectors' productive technology; employment; and the Exchequer's net tax receipts.<sup>27</sup> Detail of the model's construction is reserved until nearer the end of the report, because it builds on the evidence base provided by the literature review, case studies and survey results. For now, five points should be noted:

- i. The model sought to estimate the values headline UK economic indicators would assume under two scenarios: the first, if no institutions had implemented QM at all; the second, if all institutions had implemented QM as fully as possible. The use of scenario-based analysis enables the model to estimate the effect QM has already had on the UK economy, and the further benefits which could result if it were rolled out more comprehensively.
- ii. The model attains these headline results by breaking the entire economy down into eight broad sectors, analysing the effects QM has on outcomes in each of these sectors, and then aggregating the results.
- iii. The theory underlying this sector-based methodology, Cobb-Douglas production functions, is well-established in the economic literature. The model estimates QM's effect on sectoral production technology (as operationalised within the Cobb-Douglas framework) and this feeds through into how QM affects the sectoral outcomes.
- iv. The modelling estimates of interest are QM's effects on UK economy-wide GDP, net tax receipts and employment. The model also provides estimates for how QM implementation

has affected the production technology in each of the eight sectors.

- v. Cebr's bespoke economic model uses data from the literature review, case studies and surveys as inputs to formulate estimates of the UK economy-wide impact of QM mechanisms. The model cannot, therefore, be thought of as a source of empirical evidence in and of itself – rather, it uses empirical evidence to estimate the effects of QM. Because the model is reliant on these inputs, its accuracy as an estimation tool is entirely dependent on the extent to which those inputs are themselves accurate.

The report closes with a concluding section, in which we summarise the report's aims, methodological rationale, and principal findings.

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15. These certification bodies derive their competence to issue ISO 9001 certificates – ie they are accredited by independent national accreditation bodies. Agreements between certification and accreditation bodies ensure that ISO 9001 certificates are accepted globally.
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21. In previous iterations of the certificate, PQASSO was an acronym for 'practical quality assurance systems for small organisations'. The current version of the certificate is designed to apply to organisations of all sizes, not just small organisations. Hence, under the current version of the certificate, PQASSO does not stand for anything.
22. Charities evaluation services, CES (n.d), 'How to achieve the PQASSO quality mark', <http://www.ces-vol.org.uk/index.cfm?pg=331>
23. See the Charities Evaluation Services, CES (n.d), 'About PQASSO', <http://www.ces-vol.org.uk/index.cfm?pg=172>, for more on this discussion.
24. The model's findings will not be compared to those of the literature review, case studies and survey. Such a comparison would be redundant because the model – being built on inputs from the literature review, case studies and survey – will cohere with them by construction. For the same reason, the model's estimates of the effects of QM on headline UK economic indicators will be accurate insofar as the inputs from the literature review, case studies and survey are correct.
25. This analysis of RoI does not relate directly to the literature review, because the literature does not focus directly on the RoI of QM. The rationale underlying the organisation-level RoI analysis is to speak directly to businesses and non-private sector organisations, providing indicative examples of the benefits they might expect to see per pound invested in QM.
26. Cebr has estimated average RoIs using the case study data (see this report's Executive Summary and Conclusion). The business-specific RoI estimates which Cebr used to calculate these average RoIs varied significantly. Hence, we claim with a middling degree of confidence that the magnitudes of these average RoI estimates are representative of a typical company's experience. However, the RoI estimates mean that Cebr is very confident that a typical company can expect to gain more from implementing a QM programme than it costs them to implement it.
27. This refers to QM's effects on those net tax receipts which are derived from taxes and subsidies on products and production only.



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## 2 LITERATURE REVIEW: THE EFFECTS OF QUALITY MANAGEMENT ON BUSINESS OUTCOMES AND GDP

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### 2.1 Literature review introduction

This literature review discusses the real-world evidence of how QM systems causally affect the outcomes of private sector businesses, and of public and voluntary sector organisations. The section seeks to further Cebr's first research objective, that is to demonstrate and quantify the extent to which more effective, intensive and longer-term use of QM systems and techniques creates more productive and successful organisations.

In concluding our findings from the literature review, the different strands of the discussion are pieced together to suggest that the widespread implementation of QM procedures can: (i) improve the UK's international competitiveness; and (ii) boost its rate of economic growth. This furthers Cebr's second research objective, that is to examine how QM programmes, taken in aggregate, affect headline UK economic indicators.

The review adopts a structure whereby QM's effects on different outcome metrics are examined, cutting across the public, private and voluntary sectors. QM's effects on the following outcomes are examined: (i) stock prices; (ii) customer and user retention and satisfaction, and employee and volunteer satisfaction; (iii) costs; (iv) financial performance and profits; and (v) organisational culture. The linkages between QM's effects on these outcomes will be highlighted throughout the literature review. This structure was chosen for three reasons:

- i. There are linkages between QM's effects on these different outcomes and this structure enables those linkages to be highlighted. Any one QM programme or award can directly affect a number of different outcomes for an organisation. For instance, a single programme might affect both costs and customer retention. Furthermore, any given programme might also have indirect effects. For example, a QM programme could improve employee satisfaction and this, by making employees more productive, could go on to increase profits.
- ii. Similar (although non-identical) outcome metrics are affected by QM across the public, private and voluntary sectors. The similarity of these metrics across the different sectors means that it is appropriate to examine QM's effect on them by cutting across the different sectors.
- iii. Often, a given article or book examines the effect that a wide range of QM practices have on specific outcomes.<sup>28</sup> Hence, the literature does not lend itself to being broken down by different types of QM system, but does lend itself to being broken down by QM's effects on outcomes.

### 2.2 QM definition and preliminary discussion

The literature review begins by adopting a working definition of QM and caveats the analysis by highlighting the four main difficulties associated with discussions of QM.

This literature review and the report as a whole adopt the working definition of QM used by the CQI itself: "Quality management is an organisation-wide approach to understanding precisely what customers need, and consistently delivering accurate solutions within budget and on time. QM techniques ensure the effective design of processes that verify customer needs, plan product lifecycle and design, and produce and deliver the product or service. Finally, QM techniques measure all process elements, the analysis of performance and the continual improvement of the products, services and processes that deliver them to the customer." This definition provides a rigorous description of QM, facilitating Cebr in determining which organisational practices have a prima facie right to be referred to as QM. At the same time, it is not unduly restrictive. The application of this definition in the literature review and throughout the report ensures that the report's findings will be attributable only to those organisational practices which the CQI defines as QM.

The following preliminary discussion highlights four difficulties that occur throughout the discussions of QM in the literature. These will not be referred to going forward, but the reader should be aware of them:

1. While this report adopts a working definition of QM, there is actually no single widely-agreed definition of QM used in industry or across the public or third sectors. This means that the precise features of any given QM programme will be case-specific. A QM programme may take the form of a Six Sigma, Kaizen, ISO 9001, Total Quality Management (TQM), Taguchi, Lean Manufacturing, Kansei Engineering or another, perhaps bespoke, programme.
2. The causal effects of specific QM mechanisms are difficult to tie down. For example, if a business experiences rising profits, it is difficult to determine the extent to which the rise was due to its QM mechanism(s) or to changing market conditions.<sup>29</sup> Statistical articles are generally better at identifying QM's effects than non-statistical papers.
3. There is often a gap in time, or 'lag', between the implementation of a QM programme and its effects on outcomes.
4. Authors tend to focus on reporting cases in which QM programmes have been successful. Hence, the literature may well exhibit some bias in favour of successful cases of QM implementation.

The 1982 UK Parliament White Paper entitled 'Standards, Quality and International Competitiveness' noted that "success in world markets increasingly depends on a supplier's ability to satisfy customers on... quality." The White Paper concluded that if UK businesses implemented QM systems widely, this would increase the UK's international competitiveness and economic growth.

The literature review discusses how QM systems causally affect the outcomes of private sector businesses, and of public and voluntary sector organisations.

In concluding the literature review, the body of evidence is brought together in two ways. Firstly, there is a discussion about the extent to which the literature reviewed, when taken as a whole, supports the White Paper's conclusion. Secondly, it is noted that the main body of the literature review examines how QM programmes affect different outcomes, drawing linkages in cases where a QM programme has a significant impact on several outcomes at once. Building on the discussion of these linkages, under the framework provided by Deming's (1982) *Out of the Crisis*, the second part of the conclusion ties together the discussions on how QM affects different organisational outcomes. It does this by placing the discussions in the context of Deming's pivotal 'chain reaction' realisation.<sup>30</sup> This shows that as well as having an effect on the individual outcomes of an organisation taken separately, a QM programme is likely to act on the entire organisation, improving all its outcomes in step with each other.

### 2.3 Stock prices

The literature presents compelling evidence that QM mechanisms, when implemented effectively, have exerted upward pressure on stock prices. Corroborating this, we also found that QM failures can exert downward pressure on stock price.

Across all sectors, Hendricks and Singhal's (2001) statistical research examined the effects of the successful implementation of Total Quality Management (TQM) programmes on 608 businesses' long run stock prices in North America for the period 1983-94.<sup>31</sup> The long run stock price of a listed company can be considered a proxy for the net present value of its discounted future cash flows – ie its real value.<sup>32</sup> The authors proxied successful implementation of TQM programmes by a company through its winning of quality awards.<sup>33</sup> Hendricks and Singhal compared the stock prices of businesses which successfully implemented TQM measures (under this framework) against similar businesses which did not.<sup>34</sup>

Hendricks and Singhal (2001) contains two main findings. First, during the post-implementation period, TQM implementation was linked with increased long run stock price relative to matched control businesses. The variable of interest was the mean buy-and-hold abnormal returns (BHAR) long run stock price for the sampled TQM-implementing businesses (ie award winners). The BHAR is "the difference between the ... [stock price] returns of the sample business [which implemented a TQM programme] and its benchmark control business [which did not]." When sample businesses and controls were matched by industry only, the mean BHAR was 37.8% higher for the sample businesses than for the matched businesses. When they were matched by industry, business size and BM ratio, the mean BHAR difference was 44.7%. Second, during the implementation period, successful TQM implementation was not found to be linked to a stock price increase relative to matched control businesses. Ultimately, the authors concluded that successful TQM programme implementation "does lead to improved long run financial performance," but these results only materialise with a lag. Hendricks and Singhal's (2001) use of advanced statistical methods (comprehensively tested) mean that we can be confident that TQM's causal effects have been identified.

Linked to Hendricks and Singhal's work, for "ISO 9001 and the bottom line," Hannah (2011) conducted a review of the literature examining how the attainment of ISO 9001 certification affected stock prices against a benchmark index.<sup>35</sup> The paper notes that "over a 10-year period, ISO 9001-certified companies outperformed the market by more than 100%."

Hannah's comparison, while providing a strong indication that ISO 9001 lends businesses substantial benefits in terms of impact on stock prices, does not prove the point conclusively. It could be the case that higher-quality firms, which would have attained comparatively high stock prices anyway, are also those who were more likely to attain ISO 9001 certification. Hannah (2009) also finds that the share price differential of ISO 9001-certified firms and non-certified firms grows over time. This suggests that ISO 9001 becomes more effective the more time it has had to become embedded – ie it becomes more effective with a lag.

IMD International (2003a) examined a selection of QM failures in the consumer goods manufacturing sector. These tended to have a significant and persistent impact on businesses' bottom lines, even after the failure was remedied. In June 2000, tainted Snow Brand milk made 14,000 people unwell over a two-month period. The real value of the company (stock price) fell by one-third in two weeks. The effects proved persistent. After the scare, the new Snow Brand president predicted: "It will take several years before we become what we were [prior to the scare]." Whereas Hendricks and Singhal found that QM programme success could induce long-term stock price increases, IMD International found the reverse side of the coin; a QM failure can induce a long-term stock price fall. The Hendricks and Singhal and IMD International findings logically cohere with each other.

In the shipping services sector, Farhoomand (2004) examined Eurasia International's application of TQM. Eurasia managed ships owned by third parties and used TQM to "create value for... stockholders". Eurasia's TQM programme involved substantial management restructuring. Organisation-wide quality performance standards and a new triple monitoring system were implemented. Within 10 years, Eurasia's efforts were yielding "good financial results," and benefitting stockholders.

### 2.4 Customer and user retention and satisfaction, and employee and volunteer satisfaction

The literature provides evidence that QM mechanisms, if correctly instituted, exert upward pressure on customer and service user retention and employee satisfaction.

Farhoomand's (2004) examination of TQM as applied by Eurasia International, found that the company's efforts induced "high levels of customer retention and employee satisfaction." Staff turnover fell from 44% in 1994 to 1% in 2004.<sup>36</sup> The case study provides strong, but not statistically conclusive, evidence that Eurasia's TQM programme caused these tangible benefits.

In the Australian manufacturing sector, Oliver and Qu (1999) examined the effects of QM systems that had been implemented by firms certified under the AS/NZS 9000 standard. For the period 1992-96, they found that customer complaints had fallen for 66.6% of the businesses which had introduced a QM system. This was partially due to QM reducing the reworking or scrapping of goods for 69.2% of businesses implementing it. Overall, the introduction of QM systems decreased customer complaints and increased customer satisfaction. Making the reasonable

assumption that an existing customer is less likely to defect the happier he or she is with the company's product, Oliver and Qu (1999) suggests that winning AS/NZS 9000 certification also helps businesses increase customer retention.<sup>37</sup>

In the financial services sector, Reichheld and Sasser (1990) found that QM systems improved customer retention rates. They pointed to MBNA America (a credit card company) that undertook a quality improvement drive for the period 1982-1990. By 1990, MBNA America's customer defection rate had fallen to 5% versus a 10% industry average. Their case study-based paper does not rigorously prove that QM systems improve customer retention rates, but it does provide convincing evidence to support the argument.

Osseo-Asare *et al* (2007) examined how eight TQM practices affected "academic quality improvement" in UK higher education, using cross-sectional data drawn from 42 UK Higher Educational Institutions (HEI). To the extent that TQM programmes improve the quality of academic outcomes, they will – it was assumed – have increased student satisfaction. All other things being equal, this will have decreased the drop-out rate, increasing student retention. Principally, Osseo-Asare *et al* found:

1. 27 out of 42 HEIs... thought their QM practices were "highly efficient" in the management of resources for achieving academic quality improvement objectives.
2. 19 of the 42 HEIs reported that "using relevant and reliable information" proved "'highly' or 'very highly' effective" in improving academic quality outcomes.
3. 16 of the HEIs responded that "efforts to empower staff" were "'highly' or 'very highly' effective" in improving academic quality outcomes.
4. 13 reported that "efforts to meet and exceed stakeholder needs" proved "'highly' or 'very highly' effective" in improving academic quality outcomes.

Osseo-Asare *et al* (2007) found evidence that UK HEI respondents believe that TQM practices have improved academic quality. As a consequence, TQM procedures can be expected to have increased student satisfaction and decreased student attrition.<sup>38</sup>

Staying with the public sector, the Health Foundation (2006) and the Dr Foster Hospital Guide (2009) shift the focus to QM's effects on patient satisfaction in the NHS. Both found that patient health and mortality monitoring mechanisms improved NHS care quality – the supposition being that this improved care quality went on to increase patient satisfaction.<sup>39</sup> The Health Foundation found that "patients... want information about service quality so they can make informed choices" about where to seek healthcare. The clinical monitoring mechanisms attain this information, which patients then have access to. By providing information about service quality, these mechanisms improve patient satisfaction. The Dr Foster Hospital Guide found that "measuring and monitoring death rates has... driven improvements" in the NHS. For example, in the case of Mid Staffordshire Hospital, the Guide maintained that improved monitoring systems decreased the "mortality ratio [from] more than 27% above average [to] 7% below average... in just two years." By decreasing mortality ratios, clinical monitoring mechanisms will have improved patient satisfaction in the NHS.

In the voluntary sector, the Centre for Voluntary Action Research at Aston Business School used case studies to identify how QM impacted volunteer and employee satisfaction and service

user retention in the UK voluntary sector.<sup>40</sup> The Centre's report identified three mechanisms whereby the successful implementation of QM programmes improved volunteer and employee satisfaction and service-user retention.<sup>41</sup> PQASSO was often found to have had a particularly marked impact.<sup>42</sup> The report concluded that:

- i. QM increased opportunities for stakeholders to "work together... to address issues of common concern," fostering a willingness to challenge ingrained practices. In particular, by increasing employees' and volunteers' ability to work together to address common concerns, PQASSO increased workplace satisfaction.
- ii. QM systems improved service development and provision, but identifying causation proved difficult. Echoing others, one organisation commented that "we now offer better services [and] membership has increased by 50%, which we attribute to... the PQASSO process." Via improvements in service provision, QM put upward pressure on service-user retention.
- iii. QM certification increased organisations' legitimacy with stakeholders (eg service users, fundraisers and local authorities). One respondent noted that PQASSO certification "has given us external credibility." Bespoke QM mechanisms were also commented on as having had a similar effect. By increasing organisations' perceived legitimacy, the institution of QM mechanisms should exert upward pressure on customer and service-user retention, and employee and volunteer satisfaction.

## 2.5 Costs

The literature identifies two ways in which the application of QM mechanisms improves cost efficiency. They restructure organisations' cost base, which feeds through into higher profits for the private sector. They also reduce costs per unit of a good or service produced. The improvement of cost-efficiency by QM mechanisms is closely linked to profits, an issue which will be explored here and in the next sub-section. There is some evidence that QM mechanisms reduce costs more effectively in the private sector than in the public sector. Finally, because public sector institutions do not have profits *per se*, costs are treated as their headline financial indicator. As such, QM's effects on public sector costs are discussed both in this sub-section and in the following sub-section, which focuses on financial performance and profits.

Across the private sector, Levine and Toffel (2010) used the results of a 1,000-firm Californian panel data study to identify the relationship between QM and "per worker accident costs," by examining the effects of adopting ISO 9001 on this metric.<sup>43</sup> Levine and Toffel's results came from a rigorous application of statistical methods.<sup>44</sup> They attained two principal findings: Firstly, at the time of adopting the ISO 9001 standard, businesses which had adopted ISO 9001 had lower per worker injury costs than comparable firms which had not adopted the standard. In its own right, this finding does not indicate that ISO 9001 adoption caused reductions in worker accident costs, only that firms which chose to adopt ISO 9001 were observed to have lower worker accident costs already. However, Levine and Toffel's second finding does suggest that firms which adopted ISO 9001 were more likely than comparable firms which had not adopted the standard to report no worker injuries or lower per worker injury costs in the years following adoption. Overall, Levine and Toffel concluded that there was "limited support for [the hypothesis] that ISO 9001 adoption lowers [worker] injury rates and costs."<sup>45</sup> But, if there is sufficient structural similarity between the UK and

Californian economies, it is reasonable to assume that at least Levine and Toffel's (2010) caveated results hold for UK businesses.

Womack, Jones and Roos (1990) emphasise that if Lean QM programmes are to successfully reduce costs, managers and employees must be actively focussed on controlling costs in accordance with Lean procedures at every stage of the productive process. Their discussion is derived from an analysis of automobile manufacturing, but can be applied more generally. Lean programmes aim to reduce costs through, primarily: (i) removing wasted steps in the production process; (ii) reducing the costs of those steps; and (iii) introducing a flow between those steps and across the business as a whole.

For Lean to be successful, Womack, Jones and Roos (1990) emphasise that two principles must be upheld. Firstly, within each department, efforts must be directed toward adding value to the final product. They note that, in some poorly organised companies, "much activity is unfocussed... [and effort is wasted working] on products that never get the green light." They argue that in companies which have implemented Lean effectively, managers tend to hold the view that "if you aren't working directly on a product actually heading for the market, you aren't adding value." Womack, Jones and Roos (1990) maintain that employees must be focussed on adding value directly to the saleable product if Lean is to be successful in reducing costs.

Secondly, Womack, Jones and Roos (1990) maintain that there must be a commitment to introducing synergies between all of the business's processes and departments. There must be a melding together of the business's finance, personnel management, supply chain and product chain activities. Lean programmes will be more successful to the extent that these different aspects of the business are well coordinated with each other. Insofar as these facets of a business are not in harmony, the costs of inter-departmental mis-coordination can rise. Such costs occur when one department is late in producing an output which another department requires, meaning that work slows down or stops. They can also occur when one department completes a piece of work that another department does not require, leading to wasted work.

A business's ability to uphold these principles is obviously dependent on its managerial and employee culture. Building on this, in the 'organisational culture' subsection of the literature review, Womack, Jones and Roos (1990) is again discussed, focussing on how a business's culture affects its ability to implement Lean programmes effectively.

Beecroft (2000) noted that businesses incur two types of system costs and that effective QM programmes can restructure both of these: "Prevention costs" are "planned costs incurred to ensure that errors are not made at any of the various stages during the delivery process of [a] product or service. Appraisal costs" are the "costs of verifying, checking or evaluating a product or service... during the delivery process."<sup>46</sup> In the private, public and voluntary sectors, Beecroft (2000) noted that "by spending more money on prevention, appraisal [costs] can be reduced." So, reallocating resources toward prevention means that a well-instituted QM programme can restructure and reduce a business's costs. Second, this cost reallocation – by decreasing the number of low-quality products and services which reach the market – means QM programmes can decrease product recalls, reputational damage and returns.

Despite the wide applicability of Beecroft's (2000) argument, Scharitzer and Kokrunka (2000) argue that the nature of outcomes in the public sector (as opposed to those in the private sector) makes quantifying the effects of QM in that sector comparatively challenging. Their observations apply to all types of outcomes, not simply Beecroft's cost-based outcomes. Scharitzer and Kokrunka (2000) noted that public sector organisations do not produce the same unequivocal outputs as private businesses; namely profits or stock prices. Because public sector organisations often quantify outcomes using more subjective survey-based measures, quantifying the effects of QM on their outputs is more challenging. Also, different public sector organisations employ different metrics for quantifying outcomes, hence the effects of QM programmes are not directly comparable across public sector organisations.

Despite the concerns of Scharitzer and Kokrunka, several authors have found that QM programmes can decrease public sector organisations' costs, thereby increasing financial efficiency. Cohen and Brand (1993) suggest that QM practices can be applied in the public sector to attain efficiency gains. The authors argued that QM systems have improved service quality and productivity, and reduced waste in the US public sector.

Osborne and Gaebler's (1992) case studies found that QM enables public sector organisations to compete against private businesses. They found that pro-competition reforms increased public sector productivity for US municipal trash collectors.<sup>47</sup> Applying Osborne and Gaebler's logic to the UK public sector, the pro-competition NHS quasi-market reforms would have been expected to improve cost-efficiency throughout the NHS.<sup>48</sup> Despite the quasi-market reforms' limitations "lower transaction costs, and increased service provision for lower costs (ie increased efficiency)" were found to have resulted from the quasi-market.<sup>49</sup>

Mani (1995) examined TQM programme implementation by the US Internal Revenue Service. The programme improved outcomes because it was implemented consistently over a long period. He concluded that public sector output gains will only be maintained if TQM is instituted consistently across public sector organisations. Assuming that the UK and US public sectors are structurally similar, the above findings could be taken to also apply to UK public sector organisations.

The Scottish Executive (2006) found that the implementation of Lean QM mechanisms promoted a "greater focus on prevention rather than correction of errors" in the Scottish public sector, supporting Beecroft (2000).<sup>50</sup>

## 2.6 Financial performance and profits

The literature presents evidence suggesting that QM systems put upward pressure on the financial performance of public, private and voluntary sector organisations. Specifically, they increase the profits of private sector organisations and decrease the costs of public sector organisations. The literature also finds evidence of linkages between QM's effects on outcomes such as employee satisfaction, customer retention and costs (on the one hand) and profits or financial performance (on the other). Specifically, the literature suggests that QM programmes improve non-financial outcomes, and these improvements go on to improve headline financial indicators (such as profits).

Returning to a paper which was discussed earlier, Reichheld and Sasser (1990) found a strong link between QM's effect on customer retention and on profits. They note that "companies can boost profits by almost 100% by retaining just 5% more of their customers." They found that the decrease in MBNA's customer-defection rate which resulted from its 1982-1990 QM programme, caused its profits to increase 16-fold.<sup>51</sup> The authors also found that "reducing defections by just 5% generated 85% more profits in one bank's branch system."

Continuing on from the discussions in previous subsections, when QM systems lower private sector businesses' costs, all other things being equal, they increase their profits. Beecroft (2000) predicted that, when a QM programme induces a shift from appraisal to prevention costs, this reduces the overall costs associated with the QM programme. All else being equal, this will also increase business profits. Similarly, Levine and Toffel's (2010) finding that the adoption of ISO 9001 decreases per worker accident costs, means that ISO 9001 is also likely to boost profits.<sup>52</sup>

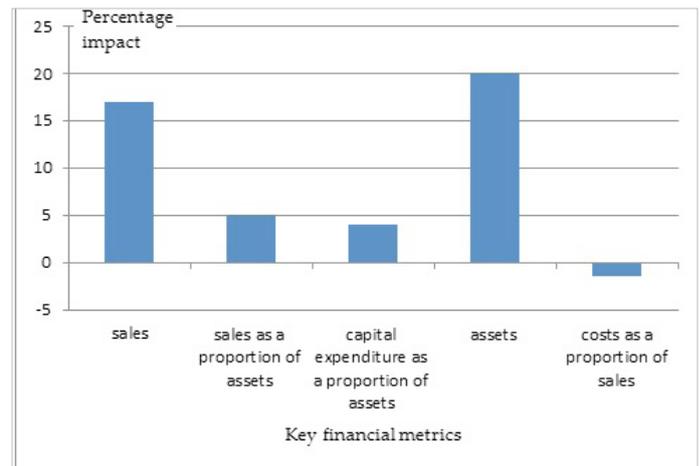
Oliver and Qu's (1999) study of the Australian manufacturing sector found that 70% of 134 surveyed businesses anticipated increased profitability through reductions in the costs associated with rework and scrap, through better QM. Linking back to customer retention and satisfaction, 75% of the surveyed businesses also hoped to increase profits by reducing customer complaints and attrition through improved QM systems. Collins and Nussey's (1994) analysis of a Science and Engineering Policy Studies Unit (SEPSU) study found that the implementation of ISO 9001 could also provide a boost to profits.

Hannah (2011) shifts the focus of the discussion by reviewing the literature comparing the return on assets (RoA) of "paired organisations, which were initially similar in terms of size, sector, profitability, etc," but where one of the pair adopted ISO 9001 and the other did not.<sup>53</sup> Hannah finds that the RoA of the adopter began increasing (relative to that of the non-adopter) two years before certification occurred. The RoA differential continues to increase even after adoption. Because Hannah's review examined 'paired' businesses, his results indicate that ISO 9001 certification does cause increased RoA. Hannah's results indicate that the RoA differential of matched ISO 9001-certified and non-certified businesses in the industrial machinery industry increases over time. This suggests that ISO 9001 becomes more effective the longer it is in place – ie it becomes more effective with a lag.

Like Hannah (2011), CQE (2005) examined how attaining a QM certificate or award under the European Foundation of Quality Management (EFQM) Model framework affects a business's financial outcomes.<sup>54</sup> CQE compared the financial results of businesses which won the award against those of similar, or 'matched', businesses which had not won the award. Echoing Hannah's results, CQE finds that "award-winning companies experience higher increases in sales, capital expenditure [as a share of] assets, capital expenditure [as a share of] sales, asset growth and reductions in costs [as a share of] sales."

These findings suggest that winning an EFQM Model award improves financial performance. The following table summarises CQE's main results, indicating that winning an EFQM Model improves key financial indicators. The figure below details the average percentage differences between the changes in performance measures for winners and for non-winners three years after winning the EFQM Model award.

Figure A: Percentage impact of winning an EFQM award on key financial metrics<sup>55</sup>



In the automobile manufacturing sector, Cole and Flynn (2009) examined the linkages between QM systems' effects on product reputation, revenues and market share. Examining US and Japanese auto-manufacturers they found that, when QM procedures induced a reputation for high quality, this improved brand equity and market share. Recognising an explicit link with financial performance, Cole and Flynn noted that increased market share induces higher revenues because: 1) the probability that a customer will purchase from the manufacturer increases; 2) a higher-quality car has a higher resale value, and 3) the reputation for quality makes it easier to sell an entry-level car and then move the customer up the value-chain.

The authors found a linked chain of improvements: QM increases the reputation for quality, which increases market share, which improves financial outcomes. Cole and Flynn (2009) also noted that there was often a delay between an automobile manufacturer successfully instituting a QM programme and it's achieving a reputation for high quality that supported its market share. This was particularly true when competing against other automobile manufacturers that had already attained a reputation for quality. This suggests a lag between the implementation of a QM programme and it becoming effective in terms of increasing market share.

QM also affects the financial performance of public sector organisations and similar linkages between QM, financial performance and other metrics apply. For instance, the aforementioned Scottish Executive report used case study evidence to analyse how Lean QM affected Scottish public sector organisations.<sup>56</sup> Lean was originally applied to manufacturing by Toyota with five core principles: "specify the value desired; identify the value stream... challenge all of the wasted steps; make the product flow continuously; introduce pull between all steps; the time and information needed to serve the customer [should] continuously fall." The Scottish Executive's definition of Lean combines these principles with Rapid Improvement Events which make "small, quickly introduced changes."

The Executive's report found that Lean had improved public sector financial outcomes, to the extent that the case study respondents correctly identified causal effects. Implementing Lean produced quantifiable outcomes, some of which were as follows:

1. "Processing times were reduced by two-thirds in one local government department."
2. There was "improvement in patient flow time of 48%" for another department.

3. There was a “reduction in staffing and costs [causing a] £31m budget saving in 10 months” for yet another department.

The reductions in processing and patient flow times which occurred as a direct result of departments’ applications of Lean are then linked to financial performance. For instance, increasing patient flow times implies a decrease in the cost per patient treated, improving financial performance.<sup>57</sup>

This subsection finishes by reviewing a seminal paper by Kaynak (2003). More than any other, this paper rigorously demonstrates how different TQM practices have interlinked and latticed impacts on a variety of outcomes. Kaynak quantifies how TQM affects these outcomes, and then how the changes which TQM induces feeds into improved financial and market performance. Across all sectors, Kaynak built a quantitative structural model investigating seven TQM practices and their effects on three business outcomes, namely “inventory management performance”, “quality performance”, and “financial and market performance”. The seven TQM practices whose effects on the three outcomes investigated were: “management leadership”, “training”, “employee relations”, “quality and data reporting”, “supplier quality management”, “product/service design”, and “process management.” Kaynak’s data source was a cross-sectional study of US businesses from 48 states.

Kaynak investigated the relationships between these different TQM practices. Relationships 1) to 13) below suggest that several TQM practices had no direct effect on the three business outcomes. Results 14) to 18) show, however, that these particular TQM practices affected the three outcomes indirectly, via their impacts on other TQM practices.<sup>58</sup> Results 14) to 18) show which TQM practices directly affected the outcomes, and how the outcomes affected each other. All relationships were found to be significant at the 1% level, unless otherwise stated.<sup>59</sup> Kaynak’s study provides rigorous quantitative evidence of how different TQM mechanisms interrelate and affect businesses’ financial outcomes. It is a valuable contribution to the literature and so is explained in full. The TQM practices in 1) to 13) below affected each other, but did not directly affect the three business outcomes considered:

1. Better management leadership caused improved training.
2. Better management leadership caused improved employee relations.
3. Better management leadership caused improved supplier quality management.
4. Better management leadership caused improved product design.
5. Better training improved employee relations.
6. Better training improved quality data and reporting.
7. Improved employee relations caused improved quality data and reporting.
8. Quality data and reporting caused improved supplier quality management.
9. Quality data and reporting improved product design (10% significance).
10. Quality data and reporting caused improved process management.
11. Supplier QM caused improved product design (5% significance).
12. Supplier QM caused improved process management (5% significance).
13. Product design caused improved process management.

The following TQM practices were directly related to the three business outcomes:

14. Better supplier quality management caused improved inventory management performance.
15. Better product design caused improved quality performance.
16. Better process management caused improved quality performance (5% significance).

The following relationships between the three outcomes were observed:

17. Inventory management performance caused improved quality performance.
18. Quality performance caused improved financial and market performance.

Kaynak (2003) found, therefore, strong real-world evidence that implementing TQM practices improves three financial and non-financial business outcomes across all sectors. He also found quantitative evidence of the chain linking TQM implementation to non-financial business outcomes, and then estimated how these fed through into financial outcomes. Note that Kaynak found linkages between QM’s effect on metrics relating to costs (such as supplier quality management and improved process management) and the final effect on financial performance. Kaynak’s (2003) advanced research and statistical methods engender confidence that the relationships established are causal.

Deming’s pivotal insight was that QM programmes can bring about a “chain reaction” such that one QM programme can affect several business outcomes, both directly and indirectly.<sup>60</sup> This is discussed in the conclusion. For now, one should note that Kaynak’s analysis echoes this crucial insight by Deming.

## 2.7 Organisational culture

Several papers find evidence that QM programmes have affected the culture of private and public sector organisations. These QM-instigated cultural changes represent an improvement because they refocus attention on customer requirements and boost financial performance. Taking a step back from how QM affects institutional culture, one paper discusses what organisational cultural conditions are required for the successful implementation of QM programmes.

In support of Levine and Toffel’s (2010) discussion, across all sectors, Collins and Nussey (1994) found that gaining ISO 9001 certification increased profits via its effects on company culture. In particular, gaining the certificate promoted “a greater awareness of quality issues and internal and external cultural changes.”

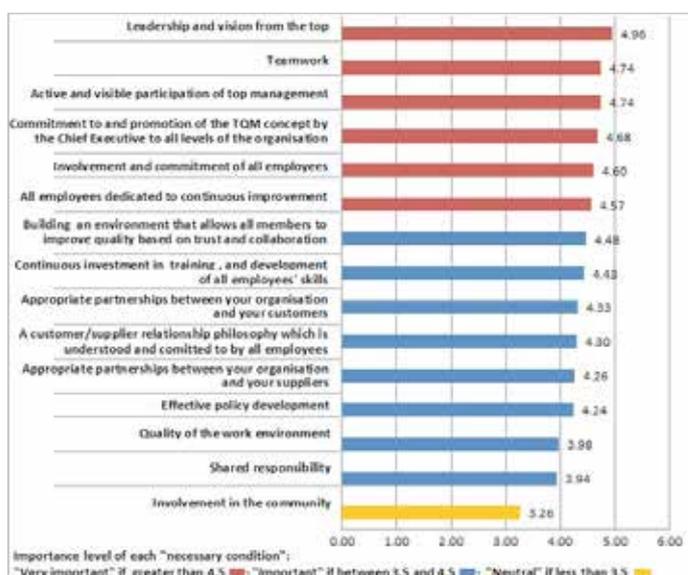
The aforementioned Scottish Executive (2006) report into Lean found that it engendered “culture changes” in Scottish public sector organisations. These cultural changes induced “focus on customer requirements” and a “better understanding of the needs of the customer.” This renewed focus on customers’ concerns agrees with what some authors hold to be one of Lean’s principal aims.<sup>61</sup> The Executive’s report noted that Lean implementation directly improved both organisational culture and (the aforementioned) financial performance in the Scottish public sector. As well as these direct effects, Lean also had an indirect effect: by improving culture, it improved financial performance.

Across the manufacturing and services sectors, Gallear and Ghobadian (2004) analysed which elements of business culture

were “necessary conditions” for the successful implementation of TQM practices.<sup>62</sup> Their objective was “to discern the channels that facilitate organisational culture change in the context of TQM... and... establish the relative importance of these channels.” Postal questionnaires were completed by 47 businesses, describing what elements of their business culture were “necessary conditions” for the successful implementation of TQM practices and culture. Respondent firms then attributed a score to the importance of each of these “necessary conditions.”<sup>63</sup>

The table below summarises their findings. Notice that active and visible commitment of senior management, teamwork and the dedication of employees throughout the organisation are asserted to be the key preconditions of successful TQM implementation. The importance of these factors to successful QM programmes is emphasised elsewhere in the literature.<sup>64</sup>

Figure B: Business culture requirements for the successful implementation of TQM practices<sup>65</sup>



Finally, Womack, Jones and Roos (1990) examined evidence from the case of Toyota in the post-war 1940s suggesting that, in the context of Lean production, a culture of employee loyalty to a business is often a key driver of its success. They argue that cultural factors can help minimise the costs of the different steps of the productive process.

After significant employment disputes, Toyota reached a labour relations agreement with its unionised employees which had three principal components: (i) a lifetime employment guarantee; (ii) pay which was steeply graded by seniority and tenure; and (iii) the use of recreational and housing facilities. The settlement meant that workers “became members of the Toyota community, with a full set of rights.” This engendered employee loyalty to the company and employees being “active in promoting the interests of the company, by initiating improvements rather than merely responding to problems.”

This enhanced culture of employee loyalty to Toyota had benefits which tied in with the aims of a Lean production process. By staying at the business for an extended period, workers were able to build up “enhanced skills [and a great deal of] knowledge and experience.” The company was able to tap into this employee knowledge and skills base to gradually improve its processes, restructuring costly steps in the production process, and introducing greater continuity between those steps.

Tying into cost reduction, the loyalty culture encouraged employees to act preemptively, rather than simply responding to problems after they occurred. This kept production costs down by encouraging employees to arrest the development of costly errors before they impacted notably on the production process.

## 2.8 Conclusions from the literature review

The literature reviewed examined individual organisations or groups of organisations within sectors. This yielded a body of evidence suggesting that the successful implementation of QM procedures, and winning QM awards and certification, improves outcomes for organisations in the public, private and voluntary sectors. QM was found to improve outcomes in the following areas: (i) stock prices; (ii) customer and user retention and satisfaction, and employee and volunteer satisfaction; (iii) costs; (iv) financial performance and profits; and (v) organisational culture. Furthering Cebr’s first research objective, the literature review has demonstrated that the effective implementation of QM programmes creates more productive and successful organisations.

Throughout this review, we have endeavoured to establish linkages between QM’s immediate effects on multiple outcomes.. Any one QM programme or award can directly affect a number of different outcomes for an organisation. Furthermore, it might also have indirect effects. For example, a QM programme could improve employee satisfaction and this, by making employees more productive, could go on to increase profits. In particular, the literature revealed a large number of links between QM’s effect on financial performance and profits, and its effects on other outcomes. For example, one paper, Reichheld and Sasser (1990), found that QM improved customer retention and that this had the indirect effect of improving profits. The Scottish Executive report found that Lean implementation improved public sector organisations’ financial performance and culture, directly and contemporaneously.

The UK Parliament White Paper (1982), ‘Standards, Quality and International Competitiveness’, concluded that the implementation of QM systems by UK businesses could: (i) improve the UK’s international competitiveness; and (ii) boost its rate of economic growth. The literature review presented evidence indicating that the implementation of QM systems and winning QM certification and awards improved business profitability, cost-efficiency and customer satisfaction and retention. To the extent that any one business’s QM strategy improved its customer satisfaction and retention, when the customers were foreign businesses or consumers, it will have improved that business’s international competitiveness. Aggregated to the level of the UK economy, the literature review’s findings (which relate to individual businesses and sectors) suggest that QM thus improves the UK’s international competitiveness.

By increasing cost-efficiency and profits, the literature suggests that QM programmes can improve individual business and individual public and voluntary sector organisation productivity. Aggregated to the level of the UK economy, this suggests that QM mechanisms can boost the rate of economic growth. Overall, although the literature review did not examine the effects of QM on the UK macroeconomy directly, its findings indicate that the widespread implementation of QM procedures by UK public, private and voluntary sector organisations can: (i) improve the UK’s international competitiveness; and (ii) boost its rate of economic growth. This furthers Cebr’s second research objective,

examining how QM programmes, taken in aggregate, affect headline UK economic indicators.

A key theme throughout the literature review has been one of linkages: any given QM programme can affect multiple outcomes at once, either directly or indirectly via its impact on other outcomes. Building on the discussion of linkages, there follows a final discussion that furthers this report's first research objective – demonstrating how QM systems and techniques create more productive and successful organisations.

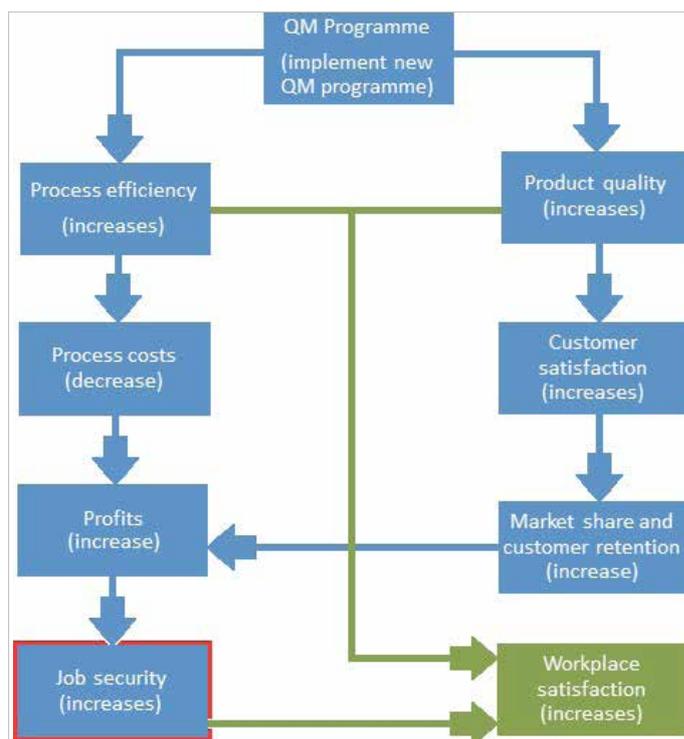
In what is arguably the seminal work of the QM literature, *Out of the Crisis* (1982), Deming builds on this theme. He noted that a well-constituted QM programme can bring about a “chain reaction,” linking the initial programme to improvements in a variety of organisational outcomes which feed into improved financial performance.

Deming reasoned that a successful QM programme will typically have the following chain reaction structure and he identified the indirect chain of causation of a QM programme on business outcomes as being particularly important:

- i. A QM programme will make productive processes more efficient, decreasing the costs associated with rework, mistakes and delays. The costs of each unit produced will fall as the efficiency with which inputs are used increases. Here, Deming has identified that the direct impact of QM often constitutes a reduction in costs.
- ii. As a consequence of lower costs, all other things being equal, profit margins improve. Here, Deming argues that QM programmes often raise profits indirectly, via their effect on costs.
- iii. Deming also noted that QM programmes tend to have a direct and positive impact on the quality of the goods and services produced, increasing customer satisfaction.
- iv. This indirect impact on customer satisfaction drives up market share and customer retention, which, all other things being equal, will also improve profits.
- v. QM's indirect impacts on costs, market share and customer retention were found to increase profits. All other things being equal, a more robust company balance sheet lowers the probability that the company will need to lay off staff. Hence, by indirectly improving job security, QM can improve employee satisfaction.<sup>66</sup>
- vi. Deming also reasons that, by increasing product quality, QM improves employee satisfaction by giving workers increased “pride of workmanship.”
- vii. Finally, Deming notes that by improving productive efficiency, QM decreases the effort a worker must exert to produce a unit of output. This improves workplace satisfaction as well as costs, if lower worker effort is associated with time savings.

Deming's chain reaction (described in points i to vii above) is summarised in the flow diagram below.

Figure F: The ‘chain reaction’ of QM impacts<sup>67</sup>



Deming's discussion ties together the literature by demonstrating that, as well as having an effect on the individual outcomes of an organisation, a QM programme is likely to act on the entire organisation. Both directly and indirectly, QM programmes improve a variety of business outcomes and so have a holistic effect on the entire organisation.

#### References

28. For example, articles often claim to be examining the effects of Total Quality Management (TQM) when they seem to be examining the effects of QM in a more general sense. This may be the case with Hendricks and Singhal (2001) and Farhoomand (2004). Other articles openly examine the effects of a selection of failures in different types of QM programmes on one single outcome metric – stock price. See IMD International (2003a). Other articles examined the effects of QM, defining QM generally. See Centre for Voluntary Action Research at Aston Business School, entitled ‘The Adoption and Use of Quality Systems in the Voluntary Sector - Final Report’.
29. Ironically, this difficulty can be due to the effective implementation of QM programmes. For example, an effectively implemented TQM programme should blend seamlessly with all aspects of an organisation's structure and productive processes. This seamless blending, which occurs when the TQM programme has been well conceived and well implemented, makes it difficult to distinguish the programme's effects from those of the underlying organisational structure.
30. See the conclusion of the literature review, sub-section 2.8, for a full explanation of Deming's ‘chain reaction’.
31. TQM is an integrated management approach, aimed at improving the quality of a business's outputs by improving oversight mechanisms, management structures, employee incentivisation, etc. See Ahire (1997). The precise features of a TQM programme are largely case specific. Stringham (2004) notes that TQM “tends to be an eclectic and sometimes disconnected mix of quality management and organisational change ideas.”

32. For a listed company, the value of all its shares is its market value. Because the real value of a company is the value of the profit-generating potential of all its assets (eg machinery, employee knowledge, future profitability, etc), the stock price should reflect these assets' earning potential.
33. The paper assumes that each business's TQM programme was implemented successfully one year before it won the award. The five years after the TQM programme was implemented successfully is called the 'post-implementation period'. The five years before is called the 'implementation period'.
34. Businesses were deemed comparable – or 'matched' – if they were sufficiently similar in terms of industry, size, and/or book-to-market (BM) ratio. A business's book-to-market (BM) ratio is the ratio of the value of all its assets to its market value.
35. Hannah (2011), 'ISO 9001 and the bottom line', IRCA.
36. Farhoomand, 2004, Exhibit 3.
37. While there was no statistical evidence that the implementation of the quality management programmes caused the improved outcomes, inferring that a causal relationship existed is intuitively appealing.
38. The paper was not based on rigorous statistics and only found evidence that TQM has improved educational outcomes insofar as respondents correctly identified causal relationships.
39. These monitoring mechanisms adhere to this report's working definition of QM as they are designed to "understand precisely what customers – ie patients – want" and were implemented widely throughout NHS hospitals. The mechanisms also aided in the "effective design of [those] processes" which improve care quality.
40. See Centre for Voluntary Action Research (2004), *The Adoption and Use of Quality Systems in the Voluntary Sector: Final Report*
41. Causality was not demonstrated statistically in the report, but respondents provided convincing evidence of causal relationships. Voluntary sector outcomes are generally harder to quantify than private sector outcomes, because they usually rely on subjective metrics such as customer and employee satisfaction. Private sector outcomes can be quantified using more objective measures, such as profits and revenues. Voluntary sector outcomes were quantified in the Centre's report using performance measures that vary by institution and QM programme.
42. See the introductory section of this report for a description of PQASSO.
43. "Per worker accident costs" are those costs which the business experience as a result of employees having accidents at work. These costs consist primarily of compensation costs, insurance costs and legal costs.
44. They used propensity score matching, difference-in-difference estimation and cross-sectional data. Propensity score matching means that the outcomes (eg profitability, worker injury costs, etc) for treated and untreated businesses may be directly compared, provided that the businesses had the same probability of being treated (ie of adopting the ISO 9001 standard), conditional on their exogenous control variables. Table 3 of Levine and Toffel (2010) gives the Probit regression, predicting a business's probability of ISO 9001 adoption, conditional on its exogenous controls. A full explanation of the difference-in-difference estimator is quite involved. For a nice introduction to it, see Wooldridge (2009) pp. 450-455. However, we note that cross-sectional data biases commonly arise from unobservable (time-invariant) heterogeneity, while time-series data biases commonly arise from unobservable time-variant heterogeneity.
45. They used three statistical methods: 1) They collapsed the panel dataset into cross-sectional data so that they could run a Probit regression to predict the probability that an employer experienced no injuries after the match. They did this for 471 matched pairs of businesses. See Table 7 of Levine and Toffel (2010). 2) They used Negative Binomial regression to examine the causes of the number of worker injuries that matched firms reported over the sample period. See Table 6 of Levine and Toffel (2010). 3) They used normal OLS regression to examine the causes of worker injury costs over the sample period.
46. These quality management system costs are part of a larger cost structure capturing the Costs of Quality (CoQ).
47. Pro-competition reforms are a mechanism whereby, having identified service users' and taxpayers' requirements for cost-efficient public services, the state institutes a structural change procedure to deliver those aims. Thus pro-competition reforms adhere to this report's working definition of QM.
48. Under the NHS quasi-market, those NHS organisations that deliver health services to patients (eg hospitals) purchase them from NHS healthcare services' providers using their state-allocated budgets. Because hospitals can purchase from more than one provider, they buy from those which provide the best services at the lowest cost. This drives up quality while improving the cost-efficiency of healthcare service delivery.
49. Civitas, 2010, *The impact of the NHS market: An overview of the literature*
50. The Scottish Executive (2006), *Evaluation of the Lean Approach to Business Management and Its Use in the Public Sector*
51. MBNA originally stood for Maryland Bank National Association. The bank's name is now simply MBNA.
52. The SEPSU study used four data sources: an analysis of survey data, data provided by the British Quality Foundation, correspondences and interviews. SEPSU emphasised that their results are "based on a careful analysis of data."
53. RoA is a measure of the financial return which a company can expect from the assets it controls. Hannah (2006) finds that winning ISO 9001 certification increases companies' RoA figures, implying winning certification helps them to improve the efficiency with which they use their assets.
54. Centre for Quality Excellence (CQE), University of Leicester, 2005, 'Organisational Excellence Strategies & improved financial performance'
55. Extract of Figure 2 of CQE (2005)
56. Scottish Executive (2006), *Evaluation of the Lean Approach to Business Management and Its Use in the Public Sector*
57. As discussed above, costs are not always considered a headline financial indicator in the same sense as profits. However, since public sector institutions do not have profits per se, costs are discussed.
58. Eg management leadership affects inventory management performance via its effect on supplier quality management, and quality and data reporting affects quality performance via its effect on process management.
59. In broad terms, significance at the 1% level means that the probability of accepting a hypothesis that is, in fact, untrue, is very low.
60. See Deming (1982), *Out of the crisis*, MIT Press, Chapter 1
61. See the introductory section of this report.
62. Gallar and Ghobadian (2004), 'An empirical investigation of the channels that facilitate a total quality culture', *Total Quality Management*, 15(8)
63. Gallar and Ghobadian's (2004) questionnaire used a scale

where “5=very important [and] 1=not important at all.” See Kaynak (2003)

65. This is Figure 3 of Gallear and Ghobadian (2004).

66. As they are implemented, QM programmes can sometimes be associated with layoffs. This point refers to the job satisfaction of staff who were not made redundant as the QM programme was being implemented.

67. See Chapter 1 of Deming (1982).

# 3 CASE STUDIES: REPORTED EFFECTS OF QUALITY MANAGEMENT ON BUSINESS OUTCOMES

## 3.1 Structure of the case studies

Cebr conducted case studies with 18 private, public and voluntary sector organisations to determine the extent to which QM mechanisms improved their outcomes in terms of cost restructuring and rebalancing, employee satisfaction, revenues and customer retention. The return on investment (RoI) of private sector QM programmes is also estimated in cases where sufficient data was provided by respondents and could, where necessary, be supplemented by information about the interviewed organisations in the public domain. The investigation accords with the report's first aim of examining how far the effective implementation of QM techniques creates more productive and successful organisations.

The case studies are grouped into eight sectors.<sup>68</sup> This structure flows from the content of the literature review. In other words, the literature review contains broad predictions as to how QM mechanisms affect the outcomes of organisations in different sectors. Hence, the adoption of this structure means that the findings which each of the case studies yielded are readily comparable with the literature's sectoral predictions.

A comparison between the responses and our findings from the literature is included within each case study.<sup>69</sup> Furthermore, this structure allows Cebr to examine how far the case study responses for each sector are coherent with the literature's predictions. This more general analysis is undertaken in a conclusion at the end of each sectoral subsection.<sup>70</sup>

This section's grouped-sector structure means that the responses given by each case study respondent can be readily compared to those yielded by other respondents in the same sector. This enabled Cebr to estimate how far the responses given by each case study respondent were representative of their sector's case study responses taken as a whole. As a consequence, it is possible to determine how far general conclusions, as to the impact of QM on organisations' outcomes, can be drawn for each sector on the basis of the case studies. This issue is discussed at the end of each subsection.

Estimating the RoI of private sector organisations' QM programmes succinctly capture the net benefit each business is believed to have derived from its programme. The RoI data reported are estimates which have been inferred from the data provided by each respondent.<sup>71</sup> RoI estimates are only formulated in cases where the respondent has provided sufficient information to do so. Hence, RoI estimates exist for six of the 14 case studies which discuss the QM programmes of private sector institutions.

Estimates for three types of QM RoI are formulated:

1. 
$$\text{Profit RoI for QM} = \frac{\text{Rise in profits due to the QM programme. } \pounds}{\text{Cost of the QM programme. } \pounds}$$
2. 
$$\text{Revenue RoI for QM} = \frac{\text{Rise in revenues due to the QM programme. } \pounds}{\text{Cost of the QM programme. } \pounds}$$
3. 
$$\text{Cost RoI for QM} = \frac{\text{Fall in costs due to the QM programme. } \pounds}{\text{Cost of the QM programme. } \pounds}$$

Depending on the data provided, different RoIs are estimated for each private sector case study. RoI estimates are expressed as ratios in the form X:1. A value for X of greater than one is taken as indicative that the QM programme was worthwhile. In all cases studied where it was possible to calculate RoIs, the estimates of X are greater than one. This implies that QM is beneficial throughout the private sector for all three types of RoI.

In some instances, a case study respondent requested that his or her own name and/or his or her organisation's name not be disclosed. In such instances, Cebr has anonymised the case study in accordance with the respondent's wishes.

## 3.2 Manufacturing sector case studies

### 3.2.1 Case study 1

**COMPANY: SUNSEEKER INTERNATIONAL**

**RESPONDENT: SIMON HANNAM, OPERATIONS MANAGER**

**PRINCIPAL PRODUCT LINES: YACHTS, MOTOR YACHTS AND SPORTS CRUISERS**

This case study examines how the QM programme of a UK manufacturer affected its revenues, costs and customer-retention rates since 2009. The UK-based manufacturing business has 2,300 employees and an associated global dealership network in 64 countries. The UK business had a 2011 Financial Year turnover of £280m to which this case study pertains.

Sunseeker International's QM programme is named In Process Control (IPC) and was introduced in early 2009. Its main organ is a QM team, whose job it is to ensure that finished products meet three standards of quality: (i) regulatory standards; (ii) internal company quality standards; and (iii) customers' quality expectations.

The IPC programme includes technical process control aspects drawn from the Kaizen 'Plan, Do, Check, Act' and 'Lean Manufacturing' QM frameworks. The management philosophy of the 'Zero Defect' framework is incorporated, with a heavy focus on product aesthetics, as would be expected in the manufacture of such luxury items as yachts. The programme is currently used in half of the company's product lines, with incorporation into additional product lines being viewed by the company as key to future success. Senior management monitors IPC's results via a 'quality score card' system and, as of 2012, will be financially rewarded for QM successes.

The Operations Manager reported that the current cost of IPC is 2% of revenues. The expectation was, however, that most of IPC's benefits would be realised in the future, specifically:

- i. Costs are expected to be £4.5m lower in three years' time than could have been expected without the IPC programme.
- ii. Annual revenues, three years from today, are expected to be between 3% and 5% higher than in the absence of IPC.
- iii. Annual profits are expected to be between 5% and 7% higher.

Building on the data the respondent provided for the costs of the IPC programme and its expected impacts on revenues and costs three years from today, the Profit Rol of the programme is estimated for three years in the future. In 2014/15, the Profit Rol is expected to be approximately 3:1. This estimate suggests that, for private sector manufacturers QM systems can drive profit increases which more than cover their implementation costs.

The company expects IPC to have a positive impact on customer-retention rates, with the percentage of returning customers (those who buy on more than one occasion) expected to be 5% higher in three years' time. This would improve profitability because, in Sunseeker International's experience, returning customers tend to purchase higher-value chain products, wanting to buy into the 'lifestyle choice' image which Sunseeker's products represent. Cole and Flynn (2009) identified a similar effect in the US automobile market. They noted that effective QM programmes increased the likelihood that any one customer who becomes a repeat customer moves up the product value-chain.

The respondent also predicted that the IPC programme would cause increased revenues by increasing customer retention. This is consistent with a finding of Reichheld and Sasser (1990) attained in the financial services sector. They found that effectively implemented QM programmes increase customer retention and that this supports revenues. The respondent also believed that Sunseeker's QM programme had lowered costs, increasing the margin on each unit sold. The IPC programme includes process control aspects draw from Lean. The Scottish Executive's (2006) report found evidence that an application of Lean systems in the Scottish public sector had lowered costs there. It is suggested that the Lean elements of the IPC programme contributed to the per-unit cost reductions observed as a result of the programme.<sup>73</sup>

Where it has already been implemented, the IPC programme has substantially rebalanced costs away from 'appraisal costs', in which product quality is evaluated during or after the production process, toward 'prevention costs', in which processes are evaluated and designed to ensure that defective units are not produced in the first place. This rebalancing was predicted by Beecroft (2000) for all sectors. The respondent gave an example of cost rebalancing – one product line has already seen a decline in post-production per-unit test times of 200 hours. These reductions are substantial enough to enable Sunseeker to reduce its cost base in the future.<sup>74</sup> Beecroft (2000) also predicted that cost rebalancing would often lead to a reduction in costs.

### 3.2.2 Case study 2

**COMPANY: SMITH'S ENVIRONMENTAL PRODUCTS LTD**

**RESPONDENT: RON BROWN, QUALITY MANAGER**

**PRINCIPAL PRODUCT LINES: 'WET SYSTEM' AND 'DRY SYSTEM' HEATERS**

This case study discusses how the QM programme of a UK manufacturer has affected its revenues, costs and customer-retention rates since 1990. The business had approximately 60

employees in 2011 and the programme has been fully integrated into all its manufacturing processes. It manufactures convector, or 'wet system', heaters and non-convector, or 'dry system' heaters which it sells to retailers. The business services the heaters it manufactures, once they have been sold on by retailers.

The business's QM programme, which began in the early 1990s and has been fully integrated into Smith's Environmental's manufacturing processes for both types of heater, is called SPS.<sup>75</sup> The SPS programme includes technical process control aspects drawn from the 'Zero Defect Programme', 'Total Quality Management' and 'Continuous Improvement' QM systems. Under the SPS programme, the components of each heater are electronically tested and sent back to the shop floor for repair if they do not pass the tests. No heater is sold to retailers unless its components pass all relevant tests – this is the Zero Defect Programme element. From a Continuous Improvement perspective, all tested units have their test results logged, allowing the business to pinpoint systemic errors in the manufacturing process. Logging also results in 'total traceability' for all heaters once they have been sold on to (and by) retailers, making servicing them less costly.

The Quality Manager reported that SPS yielded significant benefits in 2011 and that these benefits are expected to persist and increase in the future. Specifically:

- i. The programme has decreased the number of hours required to produce a given heater, reducing labour costs per unit.<sup>76</sup>
- ii. It has decreased the probability that a unit will develop faults after having been sold on to (or by) retailers. This has reduced servicing costs.
- iii. The programme requires that the quality manager inspects the manufacturing floor on a daily basis, flagging up problems before units reach the assembly or testing stages. These inspections were estimated to have saved the business £10,000 to £15,000 in 2011.
- iv. The Quality Manager expected that these cost-based findings will become more pronounced going forward as employees absorb the cost-saving culture.
- v. Had the programme not existed, the expectation is that customer numbers would have been 50% lower than they actually were in 2011.

Points i to iv demonstrate the respondent's belief that the SPS programme has yielded notable cost reductions. The literature coheres with this finding, in which there is a large body of evidence suggesting that QM programmes lower costs. In the manufacturing sector, Oliver and Qu (1999) found evidence that most businesses believe that QM systems can be an effective cost-reduction tool. Similarly, Hannah (2011) finds that manufacturers who were awarded ISO 9001 certification saw costs decrease relative to businesses who were otherwise similar but which had not been certified. Point iv is also corroborated by the literature. Across all sectors, Collins and Nussey (1994) found that attainment of ISO 9000 certification altered organisation's business cultures, and that these cultural changes reduced costs and drove increases in profits. Point v also ties in well with the literature. Reichheld and Sasser (1990) find that well-implemented QM programmes increased customer retention in the financial services sector and Farhoomand (2004) found a similar outcome in shipping services.

Point v implies that revenues would have been 50% lower than they actually were in 2011, had the programme not existed.

This inference requires the assumption that customers are homogenous in aggregate.<sup>77</sup> Provided this assumption holds, the revenue inference (made by Cebr) is justified.

Across the entire business, the SPS programme has rebalanced costs away from 'appraisal costs' and toward 'prevention costs'.<sup>78</sup> The respondent reported that the programme helped to rectify potential manufacturing problems before they impacted the manufacturing process significantly. He predicted that this cost rebalancing effect would persist in the future. Dovetailing with the literature, Beecroft (2000) reasoned that this cost rebalancing would occur whenever a business successfully implements a QM system and that, via cost rebalancing, overall costs are also likely to be reduced. This insight suggests that the cost rebalancing which the respondent reported as contributing to cost reductions, stemmed from his company's QM programme.

### 3.2.3 Case study 3

**COMPANY TYPE: INTERNATIONAL PACKAGING**

**MANUFACTURING FIRM, UK UNIT**

**RESPONDENT: QUALITY MANAGER (UK OPERATIONS)**

**PRINCIPAL PRODUCT LINES: DESIGN, DEVELOPMENT, PRODUCTION AND DECORATION OF PACKAGING FOR BEVERAGES, DAIRY PRODUCTS, DELICATESSEN PRODUCTS, BUTTER AND MARGARINE, WATER, BABY AND DRINKING BOTTLES, CHEMICALS, COSMETICS AND PHARMACEUTICALS**

This case study examines how the pilot Lean QM programme of the UK arm of a packaging manufacturer has affected its revenues, costs and customer-retention rates going forward. The UK arm of this packaging manufacturer had a 2011 turnover of £24m and has 230 employees. The manufacturer is a multinational business which operates predominantly in the EEA and Switzerland.

The pilot aspect of the Lean programme, which was implemented in the operations department, has been in place for a considerable period of time and its outcomes were discussed.<sup>79</sup> The respondent noted that the pilot programme was sufficiently successful to cause the manufacturer to roll-out the Lean programme across all departments in the UK arm of the business in mid-2011.

There are two elements to the Lean programme. Firstly, the business uses Lean methods to increase the efficiency of productive processes, so that a desired level and quality of output can be maintained with fewer inputs. Secondly, the Lean processes are continually reviewed to increase their impact on the efficiency of the business's manufacturing processes. The ultimate aim of the Lean programme is to reduce per-unit costs and reallocate staff within the business so that they become more productive, lowering staff costs per unit produced.

The programme is overseen by a steering committee and senior management who track quality metrics such as customer complaints. The executive team is financially rewarded if the business meets quality targets.

The pilot programme has already achieved the following results in the operations department:

- i. Machine uptime has increased by between 5% and 7%, as has machine efficiency, reducing per-unit costs.
- ii. Assuming that per-unit costs depend on machine efficiency, this suggests that the programme has decreased marginal costs per unit in the operations department.

- iii. Employee satisfaction has increased due to improved communication between employees and managers, leading to more effective workplace problem solving and conflict resolution.

Point i is coherent with one of the literature's most consistent findings: that QM programmes in general, and Lean programmes in particular, push down the costs of each unit of a good or service produced. The findings of the Scottish Executive's (2006) report also suggests that Lean pushes down organisation's costs, indicating that the respondent's opinion is coherent with events in other organisations. Beecroft (2000) attains a similar finding for all types of QM programme, again suggesting that point i above is coherent with the experiences of other businesses.

Point iii is also consistent with the literature. Farhoomand (2004) found evidence that, by contributing to increased workplace satisfaction, one business's QM programme decreased staff turnover dramatically. That paper also linked a QM programme's effect on employee satisfaction to its effect on costs, noting that increases in employee satisfaction reduce the costs associated with low motivation and high rates of staff turnover. Hence, Farhoomand (2004) suggests that part of the reduction in costs that the respondent observed in the operations department, as a consequence of the Lean programme, may have been due to the programme's effect on employee satisfaction.

### 3.2.4 Conclusion to the manufacturing sector case studies

The manufacturing sector case studies are broadly coherent with each other and with the literature.

The case studies suggested that QM programmes had reduced costs for all three businesses studied. All other things being equal, this supported their profitability. Two of the three respondents reported that their businesses' QM systems had increased revenues and customer-retention rates, and had been associated with a change in their companies' cost structures in favour of 'prevention costs'. Furthermore, two of the three respondents noted that their businesses had incentive structures in place which encouraged senior management's commitment to the QM programme. There was also significant evidence that QM mechanisms would become more effective in the future, indicating that the systems become effective with a lag.

The consistency between the different case studies drawn from this particular sector indicates a higher probability that their findings are typical of the sector as a whole.<sup>80</sup> All the above points also cohere with the findings of literature. This suggests that the manufacturing sector case study findings and the literature's findings accurately represent the effect of QM mechanisms in the manufacturing sector.

There was only limited evidence that the QM programmes had increased employees' workplace satisfaction. This was the only notable point of departure between the literature and the manufacturing sector case studies. Given that the literature predicts that QM mechanisms often increase workplace satisfaction, this finding suggests that the manufacturing businesses studied above might not be typical of most manufacturers or that they simply had not analysed this in the context of their QM systems.

### 3.3 Defence engineering sector case studies

#### 3.3.1 Case study 4

**COMPANY: BAE SYSTEMS MARITIME – SUBMARINES UNIT**  
**RESPONDENT: IAN MITCHELL, HEAD OF QUALITY**  
**PRINCIPAL PRODUCT LINES: ASTUTE CLASS SUBMARINE, VANGUARD CLASS SUBMARINE, UPHOLDER CLASS SUBMARINE AND LANDING PLATFORM DOCK**

This case study focuses on how the QM programme of the BAE Systems Maritime – Submarines Unit has affected its revenues, costs and customer-retention rates, and its expected affects going forward. BAE Systems is a multinational aerospace and defence firm with customers in over 100 countries and global sales of £22.4bn in 2010. Its UK sales were £6.7bn in 2010. The Submarines Unit, based wholly in the UK, has 5,000 employees and annual sales in the hundreds of millions.

In 2009, the Submarines Unit began the ‘Deployment of Business Quality Strategy’ QM programme, based on the Crosby QM Maturity Model in which a business can progress through five stages of maturity over six management categories.<sup>81</sup> As the Submarines Unit matures, its business objectives are gradually updated to continue driving development, a manifestation of the ‘direction and purpose’ philosophy. In 2011, the business quality objectives were: (i) the deployment of skills management processes to evaluate employee competence; (ii) taking ownership of quality; and (iii) improving the cost of quality failure measure. The QM programme has already proven effective but would only continue to be so if senior management continued to actively support it. This opinion, held by the respondent, is widely supported in the literature. Crosby’s seminal work, *Quality is Free* (1979), maintains that managers must be actively committed to QM programmes if they are to have a realistic chance of success. Swiss (1992) notes that a lack of consistent managerial commitment is a key risk factor that could make QM programmes ineffective. The programme has affected all areas of the Submarines Unit and the executive team is financially rewarded when business quality objectives are met. Tying in again with Crosby and Swiss, this incentive structure could promote management’s commitment to the programme.

The ‘Deployment of Business Quality Strategy’ programme incorporates elements of Deming’s ‘Plan, Do, Check, Act’ QM cycle and ‘Quality Circles’. ‘Plan, Do, Check, Act’ informs employees’ personal objectives which are subject to regular review. The Quality Circle aspect promotes people orientated improvement, having set up 36 quality integrated work teams to review quality performance against each of the three business quality objectives using quantitative, problem-solving tools. The QM programme has yielded significant results, and is expected to continue doing so. It has:

- i. Reduced the Unit’s measured costs of quality failure by 30% over 2010 and 2011
- ii. Increased customer confidence in the Submarines Unit.
- iii. Increased employee satisfaction via its ‘Quality Circles’ aspect, by increasing employee engagement. These findings come from the Unit’s internal surveys.

The planned introduction of new cost-of-failure measures, focussing on deep levels of granularity, will capture future gains caused by the programme which the current measures are unable to detect.

The literature did not focus on the defence engineering sector. However, in sectors outside defence engineering, QM systems

were found to increase customer and employee satisfaction, suggesting that points ii and iii hold true widely, and that BAE System’s responses were not an isolated case. Farhoomand (2004) found that well-implemented QM systems improved employee satisfaction in the shipping services sector by increasing employee engagement. Oliver and Qu (1999) found that when manufacturers introduced the AS/NZS 9000 standard, customer satisfaction rose as complaints fell significantly.

The implementation of the ‘Deployment of Business Quality Strategy’ programme has been associated with a comparative increase in ‘prevention costs’ and a comparative decline in ‘appraisal costs’ – just as is predicted by Beecroft (2000). By stopping problems before they affect the product delivery process, the Unit has reduced appraisal costs. The Unit’s products must undergo extensive post-production testing, as a matter of regulatory necessity, so the relative decline of appraisal costs compared to prevention costs has only been partial. The Beecroft (2000) paper predicts that such cost structure changes often facilitate a reduction in overall costs. This indicates that the changes to the cost structure which the respondent identified could have caused, at least in part, the reduction in the measured costs of quality failure (see point i).

#### 3.3.2 Case study 5

**COMPANY: SELEX GALILEO**  
**RESPONDENT: STEVEN BLAKER, HEAD OF OPERATIONS AND IN-SERVICE ASSURANCE**  
**PRINCIPAL PRODUCT LINES:**

**DEFENCE ELECTRONICS INCLUDING ACOUSTIC SYSTEMS, ADVANCED SENSORS, ADVANCED TARGETING, BORDER SURVEILLANCE SOLUTIONS, COMMS AND DATA LINK, ELECTRONIC WARFARE, ELECTRO-OPTICS, LASER, MISSION SYSTEM AVIONICS, NAVIGATION AND DEFENCE SYSTEMS, RADAR, SIMULATORS AND UNMANNED AIR SYSTEMS**

This case study focuses on how the UK arm of Selex Galileo’s QM programme has affected its revenues, costs and customer-retention rates. The UK arm had a 2010 turnover of £900m and had 4,100 employees. Selex Galileo is a defence electronics engineering firm which reinvests 15% of its revenues into R&D. The respondent confirmed that senior managers at Selex Galileo track quality performance metrics, and that the executive team is financially rewarded for meeting quality targets. This incentivises senior management to actively support the QM programme, tying in with Gallear and Ghobadian’s (2004) finding that managerial commitment is a core determinant of successful QM implementation.

In order to guarantee the performance of its QM systems, Selex Galileo requires all its quality professionals to hold, or at least be working toward, a Chartered Quality Institute qualification.

In July 2010, the UK arm of the business began implementing the ‘Alignment of Domain Specific Assurance Engineering to the Engineering and Product Lifecycle Phases’ QM mechanism. The programme’s total stand-alone cost was a negligible proportion of revenue.<sup>82</sup> The programme’s aim is to use quality assurance engineers’ valuable skills more efficiently, to improve contract delivery and decrease defect escape rates.

Previously, quality engineers had been assigned to specific projects or products for the duration of their lifecycles, requiring them to deliver assurance over many lifecycle phases. Each phase required different skills, so each quality engineer required a

large number of different skill sets, resulting in an inefficient and under-specialised use of their time. The programme reallocated quality engineers to the particular lifecycle phases of a given project or product, increasing their degree of specialisation and increasing time efficiency. By aligning the quality assurance engineers to specific lifecycle phases, the programme improved the identification of the root causes of quality deficiencies. The programme utilised 'Business Process Reengineering', in the form of a repeating cycle in which a process is identified, reviewed and redesigned to improve outcomes.<sup>83</sup> The 'Continuous Improvement' aspect of the programme consistently increases the efficiency and quality of productive processes by making more efficient use of quality engineers at each stage of a project's or product's lifecycle. Continuous Improvement relies on employees making incremental improvements to quality.

The programme has already affected outcomes throughout the business and is expected to do so going forward. Specifically:

- i. It has reduced current failure costs by 5%. This is roughly equivalent to a reduction in current failure costs of £600,000.
- ii. As the programme instils a quality culture in the business, then three years from today failure costs are expected to be 20% lower than they would otherwise be if the programme were not in place. This is equivalent to a decline in failure costs of £2m, to £3m.
- iii. It has raised customer-retention rates by 3%.
- iv. Three years from today, customer-retention rates are expected to be 5% higher than they would otherwise be if the programme were not in place.

Even though most of Selex Galileo's QM programme's benefits are expected in the future, its current Cost RoI estimates are impressive. When comparing the costs of the QM programme to its impact on failure costs, the current Cost RoI is estimated at approximately 13:1. This indicates that, in the defence engineering sector, a QM programme can reduce business costs enough to cover the expense of its implementation several times over.

Points i and ii indicate that Selex Galileo's QM programme will become more effective in terms of its cost-reduction effects as time goes forward – ie it has its most significant effects with a lag. This finding was apparent in the literature, especially in the manufacturing sector. Cole and Flynn (2009) found that there is often a delay between a manufacturer's instituting a QM mechanism, and that mechanism improving its market share. Hannah (2011) found that ISO 9001-certification became more effective, in terms of increasing RoA and stock price, over time. Papers, such as Reichheld and Sasser (1990), indicated that the improvements in customer retention, which the respondent indicated had occurred due to Selex Galileo's QM programme, have occurred widely. Notice that points iii and iv imply that the business's QM programme affects customer retention with a lag, echoing the findings of Hannah (2011) and Reichheld and Sasser (1990) when they are taken together.

Tying in with Beecroft (2000), the programme induced a shift in the company's cost structure: 'appraisal costs' were reduced at the same time as 'prevention costs' rose throughout Selex Galileo's UK arm. By enabling quality engineers to specialise in particular product or project lifecycle phases, the programme stops problems before they get too far along the delivery process. The reassignment of quality engineers' roles constituted a relative increase in prevention costs and facilitated a relative reduction in appraisal costs.

In agreement with Farhoomand (2004), the programme was reported to have improved employee satisfaction.<sup>84</sup>

The respondent inferred that if increased employee satisfaction had decreased employee turnover rates, it would have also gone on to increase revenues.

### 3.3.3 Conclusion to the defence engineering sector case studies

The defence engineering sector case studies are somewhat coherent with each other, and with the literature. Points of departure between the findings of the two case studies are often due to the special contracting agreements of one of the businesses studied. One of the two defence engineering businesses has one large principal client, meaning that its QM systems do not affect customer retention.<sup>85</sup> This confounding factor means that, on the basis of the two case studies, it is not possible to draw general conclusions about the impact of QM on defence engineering businesses' outcomes.

The case studies suggested that QM programmes had reduced costs for both businesses. All other things being equal, this would have increased profits. In agreement with the literature, both businesses reported that their QM programmes had increased employee satisfaction and had rebalanced costs in favour of 'prevention costs' and away from 'appraisal costs'. Again, in agreement with the literature, both noted that management commitment was a key determinant in the QM programme's success.

There are some points of departure between the case study responses for the defence engineering sector. Only one of the businesses, Selex Galileo, reported that its QM system had become more effective over time. The second business did not identify this effect, representing a point of departure from a finding which holds quite consistently in the literature. The second business did not report that its QM programme had increased revenues or customer retention. Although this does not agree with the literature or the other case study in the defence engineering sector, very little can be read into these findings. The difficulty in drawing an inference from the findings is due to one of the business's comparatively unique contracting arrangements.

## 3.4 Engineering and construction sector case study

### 3.4.1 Case study 6

**COMPANY: COSTAIN GROUP**

**RESPONDENT: BUSINESS IMPROVEMENT DIRECTOR**

**PRINCIPAL PRODUCTS AND SERVICES:**

**"CONSULTANCY, CONSTRUCTION AND OPERATIONAL MAINTENANCE FOR:**

- i. INFRASTRUCTURE (HIGHWAYS, RAIL AND AIRPORTS)**
- ii. ENVIRONMENT (WATER, WASTE, MARINE AND EDUCATION)**
- iii. ENERGY & PROCESS (NUCLEAR, POWER, AND HYDROCARBONS AND CHEMICALS)"**

There is only one case study pertaining to the engineering and construction sector. This case study examines how Costain Group's QM programme has affected its revenues, costs and customer-retention rates. Costain Group is a UK-centred engineering and construction firm which had a 2010 turnover of £1,022m and 3,800 UK employees at the end of 2011. Project and sector managers' are rewarded for meeting performance targets.

The business's QM programme, which began in 2008, involves

continually evolving Project Performance Assessments (PPAs) which are used to formulate implementable Business Improvement Plans (BIPs). PPAs allow Costain to track project performance against five enablers – strategy, leadership, partnership and resources, processes and people – each containing a set of quantifiable criteria. Projects undergo PPA reviews six weeks after commencement and regularly thereafter. Reviews facilitate BIPs which improve project efficiency.<sup>86</sup> Project performance against the enablers is monitored by senior management.

The QM programme's design and implementation costs in 2008 were a "negligible" proportion of the annual revenues. The programme uses three QM processes. The 'Plan, Do, Check, Act' cycle evaluates how well a project has attained its enabler criteria. Of secondary importance were: 'Continuous Improvement' and 'Lean as applied to processes'.<sup>87</sup> The PPA- and BIP-based QM programme has had the following effects:<sup>88</sup>

- i. Business costs have fallen. There is a strong correlation between the PPA score a project achieves during the review six weeks after its commencement and its "betterment."<sup>89</sup> This PPA serves as an early-warning system for high project costs, helping Costain to implement effective BIP measures; lowering costs.
- ii. 80% of the company's work is repeat business and the QM programme "has been a contributing factor in keeping customer-retention rates from falling in a tight market."

Point i suggests that Costain's experience is typical of the literature. The literature identifies Lean and Continuous Improvement as mechanisms which effectively reduce costs. Lean reduces costs by removing wasted steps in the production process and introducing synergies between steps; Continuous Improvement empowers workers to gradually improve productive processes and, therefore, lower costs. Resultantly, the inclusion of these concepts in Costain's PPA- and BIP-based QM programme may have been key drivers of the programmes ability to reduce costs (identified in point i).

Point ii agrees with the literature's contention that, all other things being equal, a business's successfully instituted quality management programme can improve, or at least maintain, customer-retention rates.<sup>90</sup>

The business's costs structure has been altered. Throughout the UK arm of the business, the share of costs which are 'appraisal costs' has fallen relative to those which are 'prevention costs'. This was predicted by Beecroft (2000). This change in cost-shares occurred because the QM programme's week six PPA reviews and attendant BIP measures increased prevention costs across Costain Group, while allowing the business to scale back appraisal measures. This cost rebalancing is expected to persist going forward.

### 3.5 Legal services sector case studies

#### 3.5.1 Case study 7

**COMPANY TYPE: COMMERCIAL LAW FIRM**

**RESPONDENT: CHIEF EXECUTIVE**

**SERVICE LINES: CORPORATE AND COMMERCIAL LAW, INTELLECTUAL PROPERTY LAW, LITIGATION & DISPUTE RESOLUTION, GROUP ACTION LITIGATION, INSURANCE LITIGATION, EMPLOYMENT LAW, INSOLVENCY & RESTRUCTURING, PROPERTY LAW AND PRIVATE CLIENT LAW**

This case study examines how the QM programme of a UK

commercial law firm affected revenues, costs and customer-retention rates since September 2010. The firm has 120 UK employees and had a 2011 UK turnover of £14.5m. The company's QM programme, which was implemented in September 2010, centred on consistently producing the following for all clients:

- Engagement Letters: these are the terms of engagement with a specific client and details the relevant fee structure, specific services the business will provide, and an assessment of the relevant legal issues.
- Records of Instruction: these are catalogues of all the activities, advice and direction that the firm issued while working on behalf of a specific client.

The programme has affected all of the business's legal services. The business monitors how the quality of its services affects client-retention rates and clients' willingness not to dispute fees. There is a semi-formal link between quality outcomes and the pay of partners and senior management. The pay of partners and senior management increases with the firm's profits. Insofar as service quality increases overall profits, this feeds through into the pay of senior managers and partners.

The current cost of the QM programme is "negligible", being well under 1% of revenues. This is because the programme was designed and implemented internally without absorbing excessive resources and has simply been embedded into day-to-day processes.

The Chief Executive reported that the programme had already resulted in annual revenue increases of 1%, and modest annual cost savings of less than 1%. These savings come mainly from the programme's effect on insurance premiums, which are kept lower because customer disputes over the company's fees are obviated. Furthermore:

- i. Similar outcomes are expected to be sustained in future years.
- ii. The programme increased customer-retention rates by 1%.

Assuming that the cost of the QM programme was 0.5% of revenue, this implies an estimated Revenue RoI of 2:1.<sup>91</sup> This demonstrates that, in the legal services sector, a QM programme can increase revenues more than sufficiently to cover the expense of its implementation.

Point i represents a point of departure from the thrust of the literature's findings. The fact that similar, as opposed to more pronounced, outcomes are expected in future years implies that the business's QM system realised its full potential soon after being implemented. This does not accord with those papers in the literature which found that the impact of QM systems on costs and revenues often becomes more pronounced the longer they have been in place.<sup>92</sup> Point i suggests that QM systems may impact legal services businesses more rapidly than they impact organisations in other sectors.<sup>93</sup>

The Chief Executive reasoned that the programme has helped to establish a well-structured and planned relationship with each client from the outset and that this gave clients peace of mind, thereby increasing customer-retention rates. On point ii, in a manner analogous to engendering well-structured and planned relationships with clients, papers in the literature tend to find that QM programmes, by increasing product or service quality, increase customer-retention rates. Such papers include: Hendricks and Singhal (2001), Farhoomand (2004), and Cole and Flynn (2009).

The programme has rebalanced costs away from 'appraisal costs' and more toward 'prevention costs'.<sup>94</sup> By establishing a well-structured and planned relationship with the client from the outset, and hence reducing fee disputation, the programme rebalanced the business's cost structure.<sup>95</sup>

The company reported that the programme had decreased administrative employee satisfaction slightly, but that it increased the satisfaction levels of legal staff.

#### Case study 8

##### TWO COMPANY TYPES:

- 1) DEFENCE BARRISTERS' CHAMBERS
- 2) ADMINISTRATIVE COMPANY TO THE DEFENCE BARRISTERS' CHAMBERS

**RESPONDENT: CHAMBERS ADMINISTRATOR FOR THE DEFENCE BARRISTERS' CHAMBERS, WHO IS FORMALLY AN EMPLOYEE OF THE ADMINISTRATIVE COMPANY**  
**PRINCIPAL SERVICE LINES:**

- 1) "DEFENCE ADVOCACY... INCLUDING FRAUD, TERRORISM, MURDER AND GENERAL CRIME"
- 2) ADMINISTRATION OF THE DEFENCE BARRISTERS' CHAMBERS

This case study examines how the QM programme of an administrative company which supports a defence barristers' chambers has affected the chambers' outcomes. The administrative company is the sole administrative support provider for the chambers and does not provide administrative support for any other business. The administrative company and the chambers are formally two separate businesses, but the administrative company is *de facto* the administrative arm of the chambers. The chambers is an association of 62 separate barristers, and experienced rising revenues as of 2007 to a peak of £8.2m in 2010. In 2011, turnover was only £6.4m due to a cut in the legal aid budget. The administrative company receives its income exclusively from the chambers and has nine staff. Senior administrative company employees and clerks are indirectly financially rewarded when the company's QM systems improve the chambers' outcomes because their remuneration is based on increasing the chambers' turnover. The senior management of the administrative company and the chambers track quality performance.<sup>96</sup>

The QM programme of the administrative company has improved outcomes at the chambers. In 2007, the administrative company upgraded its specialist legal diary, data management and billing software to the most advanced available version. The software had a £35,000 one-off installation cost and has a £28,000 annual technical support fee. The use of specialist software accords with this report's working definition of QM, which defines QM as "an organisation-wide approach to... consistently delivering accurate solutions within budget, and on time." The specialist software affects the entirety of both organisations and increases the accuracy of the solutions that the chambers reaches by improving data management.

The software used elements of 'Continuous Improvement' and the 'Zero Defect Programme'. Continuous Improvement stems from the software making many aspects of daily work easier at the chambers. It has increased the speed and ease with which barristers and administrative company staff can complete repetitive tasks, such as preparing accounts. The Zero Defect Programme came about because the software enabled barristers to extract information on all the chambers' cases from a central

database, allowing them to determine which type of cases would be the best to take on in terms of decreasing 'defects' – ie the probability of losing a case.

Using the software had the following effects:

- i. It reduced the labour costs by speeding up repetitive tasks.
- ii. It reduced overheads. Overheads were lower in 2010 than in 2009, and 2011 overheads (when they are calculated) are expected to be lower than 2010 overheads.
- iii. It increased revenues. In 2008, the Chamber's Administrator estimated that revenues were £750,000 higher than they would have been without the software. For context, 2008 total revenues were £8.5m. The corresponding figure for 2011 was £400,000-£500,000, when total revenues were £6.4m.
- iv. It increased client retention. In 2008, the chambers' client-retention rate was estimated to have been 10%-15% higher than it would have been without the software.<sup>97</sup> By 2011, the client-retention rate was estimated to have only been 3%-5% higher than it would have been without the software.

Building on the Revenue RoI result of the previous case study, this case study estimates an extremely impressive Revenue RoI result for a legal services business. In 2007, the one-off installation and annual technical support costs of the software-based QM programme were compared to the revenues which the respondent estimated it had generated that year. The 2007 Revenue RoI was estimated to have been 12:1. This Revenue RoI finding (especially when considered alongside the analogous result in the previous case study) indicates that, in the legal service sector, QM programmes can increase revenues significantly. It seems they are very likely to increase revenues more than enough to cover the costs of their implementation.

Points i and ii tie in well with the literature, which provides a body of evidence indicating that QM systems decrease costs. Crosby's *Quality is Free* suggests that the Zero Defect Programme element of the QM system can be expected to reduce quality failure costs. Other papers, such as Reichheld and Sasser (1990), accord with point iii by suggesting that QM systems can drive up revenues.

Point iv conflicts with the literature's general finding that QM systems often have their most dramatic impacts with a time lag. For instance, Hendricks and Singhal (2001) and Cole and Flynn (2009) suggest that QM programmes become more effective over time. The discrepancy between the 2008 and 2011 customer-retention rate impacts, which were reported by the respondent, may have come about because the most easily achievable software-based gains were exhausted comparatively early on in the software's life.<sup>98</sup>

Note that point iv accords with a response given by the first legal services sector case study, suggesting that QM procedures make their impacts relatively quickly for legal services firms. Taken together, these two case studies suggest that QM mechanisms impact legal services firms' outcomes more rapidly than the literature predicts. When compared to other cases studies, including those relating to the business services sector, these two case studies suggest that QM systems impact legal services firms more rapidly than organisations from other sectors.

The software-based QM system decreased 'appraisal costs' relative to 'prevention costs', agreeing with the predictions of Beecroft (2000). This is because installing and maintaining the

software allowed the chambers to resolve problems before they affected the service delivery process, reducing appraisal costs. The use of the software constitutes a prevention cost *per se*, furthering these changes in the cost structure.

After some initial time spent getting use to the advanced software, the respondent reported that the software upgrade improved employee satisfaction. This accords with findings in the literature reached by Farhoomand (2004) and the Centre for Voluntary Action Research at Aston Business School (2004).

### 3.5.2 Conclusion to the legal services sector case studies

The legal services sector case studies exhibited a high degree of coherency with each other, but displayed one interesting point of departure from the literature. This point of departure suggests that QM programmes become effective for legal services businesses more rapidly than for other types of businesses implementing QM. The case study evidence suggests that these rapid impacts apply only to the legal services sector (and possibly the business services sector, see subsection 3.6). The evidence does not suggest that QM programmes impact all services sector businesses comparatively rapidly, relative to non-services sector companies.

The case study findings indicate that QM systems had reduced costs and improved customer retention and revenues for both companies. They also imply that QM procedures have pushed up profits – although increases in profits were not explicitly reported by the respondents.<sup>99</sup> Both respondents explained that their business's QM system had (on balance) improved employee satisfaction and caused an increase in 'prevention costs' relative to 'appraisal costs'.

Both respondents reported that there were incentives in place to encourage management to actively support the QM programmes, or that there were mechanisms in place which facilitated management's oversight of the programmes' effectiveness. These responses anticipate the literature, which notes that managerial commitment is important to a QM programme's success. On all of the above points, the case studies agree with each other and the literature to a large extent. The high degree of agreement between the case study findings indicates that they could be typical of other businesses in the legal services sector.

Both legal services sector case study respondents indicated that their businesses' QM systems had become effective rapidly – ie there was not a significant delay between a system's implementation and its maximum impact on outcomes. The literature focussing on QM in the services sector predicted the opposite. The agreement between both case study findings on this issue, and their conflict with the literature's findings, indicates that legal services businesses may not be typical of other services. This discrepancy only applies to the speed with which QM systems become effective in different sectors.

## 3.6 Business services sector case studies

### 3.6.1 Case study 9

**COMPANY TYPE: BUSINESS AND IT SERVICES PROVIDER<sup>100</sup>**

**RESPONDENT: GENERAL MANAGER (UK OPERATIONS)**

**PRINCIPAL SERVICE LINES: E-DISCOVERY AND INVESTIGATIONS, MANAGED REVIEW, DOCUMENT PRIORITISATION, CHAPTER 11 BANKRUPTCY AND CORPORATE RESTRUCTURING, CHAPTER 7 BANKRUPTCY, BANKRUPTCY CREDITOR SOLUTIONS AND CLASS ACTION SOLUTIONS**

This case study discusses how the QM programme, called the 'Project Management Process' (PMP) of the UK-arm of a legal services and legal IT services provider has affected its revenues, costs and customer-retention rates. PMP was instituted in 2006 and has been incrementally improved ever since. The UK arm of the business stores data on behalf of its clients, who are mainly law firms, and had approximately 50 employees and a turnover of £12m in 2011. The executive team is indirectly financially rewarded for meeting quality objectives. Insofar as meeting quality targets increases profits, these increased profits feed through into the pay of the executive team. This case study pertains to QM and outcomes for the UK arm of the company.

The PMP is an end-to-end QM process. It requires sales teams to complete project initiation forms, which are cross-checked before being passed on to the most suitable project team. Teams must use detailed intranet data milestones to maximise project management effectiveness. That project teams are highly trained and have a fixed operational structure to ensure a standardised, high-quality set of procedures underlies all project delivery.

The PMP is a costly but worthwhile programme. The respondent estimated that the cost of maintaining the PMP was 10% of revenues in 2011. The respondent reported that the PMP had affected all service lines positively and has enabled the business to consistently meet its QM objectives, specifically:

- i. The programme has decreased the number of hours required for an employee to complete a task, reducing labour costs. This effect came through decreasing duplicated work.
- ii. PMP reduced overall costs by about 5% in 2011, and is expected to cause costs to decrease further each year going forward.
- iii. PMP has improved customer retention. Had the programme not existed, customer numbers were expected to have been 33% lower than they actually were in 2011.
- iv. As an inference of the customer-retention effects, the programme was estimated to have increased revenues by 33% in 2011, relative to a counterfactual where the programme was not in place.<sup>101</sup>

The respondent provided estimates of his business's QM programme's costs as a percentage of revenues and the programme's impact on revenues. The implied Revenue RoI of the PMP was approximately 3:1. This suggests that QM programmes can drive up revenues considerably in the business services sector. Furthermore, this Revenue RoI estimate suggests that business services sector QM programmes more than cover their costs.

The first two points demonstrate that the business's QM programme has decreased costs. These responses are typical of the literature, across all sectors. For example, Levine and Toffel (2010) found that QM programmes could decrease costs in the private sector. The Scottish Executive (2006) and Cohen and Brand (1995) also found that QM mechanisms drive down costs. Furthermore, point ii ties in with a key theme of the literature: quality management systems often have significant impacts years after they are first instituted. See Hendricks and Singhal (2001) and Hannah (2011). Point iii is also corroborated by Oliver and Qu (1999) and Reichheld and Sasser (1990), which indicate that QM systems can improve customer retention. Reichheld and Sasser (1990) also supports point iv, and provides a linkage between points iii and iv. The paper finds that QM systems can increase revenues and/or profits via their effects on customer retention.

The respondent reported that the ratio of ‘prevention costs’ to ‘appraisal costs’ was 1:4 in 2008, and that the PMP was the main driver in altering the ratio to 3:2 by 2011. The cost ratio is expected to hold steady at 3:2 going forward. These observed alterations to the costs structure were predicted by Beecroft (2000). The response indicates that this effect is expected to become more pronounced in the future, agreeing with those papers which found that QM systems become more effective the more time they have had to become entrenched.

PMP has improved employee satisfaction. By giving clear guidance on performance expectations, the programme has made employees surer of “where they’re at”. This decreased employee turnover and so reduced the costs associated with hiring and training employees. By decreasing the employee turnover rate, the PMP enabled clients to develop stronger relationships with the business’s UK employees, which increased revenues.

The firm is a NASDAQ-listed company. The respondent expected that the business’s global QM operations had increased its stock price, but did not quantify the magnitude of this effect.

This is not an isolated case of QM systems driving up a business’s stock price. Such events are widely reported in the literature. See Hendricks and Singhal (2001), Hannah (2011) and Farhoomand (2004).

### 3.6.2 Case study 10

**COMPANY: PMD HEALTHCARE MARKETING SERVICES (AN ORBITAL MARKETING SERVICES COMPANY)**

**RESPONDENT: MARK KELLY, COMMERCIAL MANAGER**

**PRINCIPAL PRODUCT AND SERVICE LINES:**

**MARKETING SERVICES TO THE PHARMACEUTICAL SECTOR AIDS PHARMACEUTICAL FIRMS IN COMMUNICATING EFFECTIVELY WITH THEIR CUSTOMERS BY PROVIDING SERVICES IN THE FOLLOWING AREAS: DATA, MAILING, RESPONSE HANDLING, FULFILMENT AND STORAGE**

This case study examines how the ISO 9001-based QM mechanism of PMD Healthcare Marketing Services, which provides marketing services to the pharmaceutical sector, has affected its outcomes. In 2011, the business had a turnover of £500,000 and the equivalent of five full-time members of staff. It is a member of the Orbital Marketing Services Group (OMSG) and shares staff with other companies in the group. OMSG had a turnover of £25m in 2011. PMD Healthcare employees and executives received indirect rewards for meeting quality-related objectives because if a particular project or year attained particularly good results, remuneration increased across the business.

This case study examines the effects of PMD Healthcare’s move to replace several of its stand-alone processes, with processes resourced from two ISO 9001-certified firms within the OMSG structure.<sup>102</sup> This move began in 2007, because PMD Healthcare does not hold ISO 9001 certification in its own right. This QM programme has had the following outcomes:<sup>103</sup>

- i. By guaranteeing that externally-resourced processes will attain ISO 9001 standards, PMD Healthcare’s employees and clients are more confident of the business’s commitment to quality.
- ii. A quality culture has been instilled at PMD Healthcare because the quality culture of the two ISO9001-compliant firms has partially integrated into its culture. The respondent reported that this has led to incremental year-on-year savings, but did not quantify the magnitude of those savings.

- iii. PMD Healthcare has increased its quality focus for those processes that have not been delegated to ISO 9001-certified businesses within OMSG.
- iv. Reworks and complaints have been reduced because the ISO9001-based QM mechanism has improved internal checking procedures.
- v. The QM system has put upward pressure on client retention. Some 80% of the business’s revenue is currently sourced from repeat clients.<sup>104</sup>
- vi. All these results are persistent. The Commercial Manager noted that if the QM programme were discontinued, initial cost rises would be limited because of the long-term effect the programme had had on the business’s culture.

The literature often finds that a QM programme’s implementation can increase stakeholder confidence in the organisation, suggesting point i holds true generally. The Centre for Voluntary Action Research at Aston Business School (2004) and Farhoomand (2004) both find evidence in favour of this proposition. Point iii accords with those papers which find that the implementation of QM systems can engender a cultural change, promoting a greater emphasis on quality throughout the organisation.<sup>105</sup> Point vi suggests that the effects of the business’s QM programme are persistent – ie even if the programme were cancelled, it would take some time for business costs to rise substantially. This persistence finding chimes with, although does not directly support, the literature’s findings, which suggests that QM programmes have their main effects with a lag after their institution. Whereas the literature finds that a QM system gradually becomes more effective the longer it has been in place, point vi suggests that PMD Healthcare’s QM programme’s effects take longer to die away the longer the programme has been in place.

The mechanism has rebalanced costs away from ‘appraisal costs’ and more toward ‘prevention costs’ throughout PMD Healthcare. The bulk of this rebalancing occurred from 2007 to mid-2010. Improved internal checking procedures constitute an increased focus on prevention in their own right. By stopping quality failures before they progress along the service provision process, the business has been able to reduce appraisal costs. These findings agree with cost rebalancing predictions made by Beecroft (2000).

The respondent reported that the QM mechanism had improved employee satisfaction by increasing employee engagement and engendering a quality ethos. Consequently, employee turnover rates had decreased, as had hiring and training costs. These findings are consistent with the literature.<sup>106</sup>

### 3.6.3 Case study 11

**COMPANY: AN INFORMATION TECHNOLOGY SERVICES PROVIDER**

**RESPONDENT: HEAD OF QUALITY**

**PRINCIPAL SERVICES: INFORMATION TECHNOLOGY CONSULTANCY, DELIVERY AND SUPPORT SERVICES**

This case study discusses how the QM procedure, called the Industrialisation Project (IP), of an IT services provider has affected its outcomes. In 2011, the multinational company had a turnover of €1.1bn and 13,500 employees. It exists on three levels – business units, country- or sector-level divisions, and general management – all of which have been affected by the IP. The company has two quality policy objectives: (i) increasing customer satisfaction and (ii) improving financial performance. Executive remuneration increases in the company’s financial

performance, so their remuneration is increasing through QM success, insofar as it improves financial performance.

The IP ran from 2008 to the end of 2011. It affected all of the company's service lines roughly equally and had three components:

- i. It created a new set of quality tools, thereby bringing its existing tools in line with industry-wide best practice. This root-and-branch reform caused a move from 'Waterfall'<sup>107</sup> systems management to 'Iterative Lifecycle'<sup>108</sup> processes. The move brought managers and clients closer to a project's development over its lifecycle.
- ii. Quality methods and tools were updated, making automated QM tools easily available to project teams on the company's internal network. These automated tools included code quality checkers, virtual collaborative workplaces and quality checkers.
- iii. It took over the metrics-based quality oversight function of the pre-existing quality department. Monthly internal quantitative metrics tracked project delivery, milestone attainment, revenues and costs. Projects missing profitability or man-hour allocation targets were investigated, and remedial measures were instituted as necessary.

The Industrialisation Project had a number of successes:<sup>109</sup>

- i. The company's QM mechanisms were seen to meet industry best practice. Monthly metrics enabled the company to identify underperforming projects within four days of the start of a month, facilitating rapid corrective measures where required.
- ii. These improvements increased client retention, helping the company to meet clients' quality expectations.
- iii. Increased client retention put upward pressure on revenues.
- iv. Improved quality methods and tools reduced costs. An up-to-date, corporate, standardised set of processes and automated tools decreased the employee effort required to deliver a project or service.
- v. The reduction in effort costs improved employee satisfaction.
- vi. These effects are expected to persist going forward.

Points ii to v are corroborated by papers in the literature. These papers have already been discussed. Point vi ties in with the literature, although is not directly supported by it. Hendricks and Singhal (2001), Hannah (2011) and Cole and Flynn (2009) all predict that QM systems impact headline financial metrics several years after they have been instituted. Point vi indicates that the QM programme's effects will persist going forward, but does not directly address how long they took to become effective.

IP has been rolled out to all the company's national divisions.<sup>110</sup> By providing a degree of company-wide homogeneity it has "facilitated the integration of acquisitions," leading to synergies which have put upward pressure on revenues and profits.

By increasing the frequency of quality oversight, the IP induced a shift of focus "from corrective action to preventative action."<sup>111</sup> This adjustment of focus ties in with Beecroft (2000), but is not directly supported by the paper. Beecroft (2000) predicts that QM programmes can bring about an explicit change in businesses' costs, as opposed to simply a change of focus – which may or may not coincide with analogous change in the costs structure.

### 3.6.4 Conclusion to the business services sector case studies

The business services sector case studies are broadly coherent with each other and with the literature.

On the points below, the case study findings cohere with each other and with the literature. The case studies suggested that, for all three businesses studied, the QM programmes had reduced costs and increased client retention. There was also significant evidence that revenues, profits and employee satisfaction had been increased by the programmes. For all three businesses, executive remuneration increases as the company's overall performance improves. The company's overall performance improves the more effective its QM programme is. These incentive structures acknowledge the literature's argument that senior management must actively support QM mechanisms if they are to be successful. The respondents indicated that their QM programmes had rebalanced costs – or had at least rebalanced organisation focus – away from 'appraisal' and toward 'prevention'.

Respondents in the business services sector only reported weak evidence of a significant delay between their company's QM system implementation and the system having a substantial impact on company outcomes. The agreement between all three case studies on this issue, and their conflict with the literature's findings, indicates that business services companies may not be typical of other businesses. The case studies provide weak evidence that QM programmes become effective for business services sector companies more rapidly than for companies in other sectors.<sup>112</sup>

One of the respondent businesses was a listed company which indicated that its QM programme had increased its share price, agreeing with the literature. Because neither of the other respondent businesses were listed companies, the generality of this finding could not be estimated on the basis of the case studies.

## 3.7 Transport and telecommunications sector case studies

### 3.7.1 Case study 12

**INSTITUTION: LONDON OVERGROUND RAIL OPERATIONS LTD (LOROL)**

**RESPONDENT: HEAD OF SAFETY, QUALITY AND ENVIRONMENT**

**PRINCIPAL SERVICES: MANAGING LONDON OVERGROUND ON BEHALF OF TRANSPORT FOR LONDON**

**OBJECTIVES:**

- i) To deliver a high-quality, safe service for Transport for London's (TfL) London Overground (LO) rail services.
- ii) To develop the London Overground brand and expand the network under Transport for London's guidance.

This case study discusses how LOROL's attainment of ISO 9001 certification and its pre-existing quality culture and practices have affected its outcomes.<sup>113</sup> LOROL, London Overground (LO) and TfL exist in a tripartite structure. LO, as an institution, can be thought of as London's overground rail network and a brand owned by TfL. In November 2007, LOROL, a "private sector firm with a public service ethos," won a seven-year concession to operate LO's rail track, station infrastructure and rolling stock on behalf of TfL. LOROL is incentivised to run LO according to TfL's punctuality, quality and safety standards via a system of financial penalties imposed if targets are missed.<sup>114</sup> Attaining ISO9001 certification in the three areas of the train depot, planning and control was a condition of LOROL being awarded the concession by TfL. LOROL's senior management tracks quality metrics with enthusiasm due to the concession agreement's strong quality emphasis.

For context, in November 2007 LOROL provided 90,000 passenger journeys daily with 500 staff. It presently provides 370,000 passenger journeys daily, with 1,200 staff. The journey to staff ratio has increased from 180:1 to 308:1 over the period. LOROL's annual revenue is now over £100m, and it also administers 40% more stations than it did in November 2007. LOROL expanded the scope of ISO9001 certification beyond that required by TfL's concession to include four additional areas. LOROL then conducted gap analyses before implementing ISO 9001 across the seven areas. ISO 9001 was attained for the train depot in 2010 and for the other six areas in 2011. Going forward, ISO 9001 will be expanded into stations, trains and finance. ISO 9001 was implemented with limited costs because it fitted well with LOROL's pre-existing quality culture and practices.

Attaining ISO 9001 certification delivered the following results:

- i. Quality improved, modestly reducing TfL's financial penalties imposed on LOROL. Improvements in quality were due predominantly to LOROL's pre-existing quality systems. The impacts of ISO 9001 (over and above those of LOROL's pre-existing programmes) were modest.
- ii. The future intended rollout of ISO9001 into stations, trains and finance is expected to further reduce costs, although the effect may be quite weak.
- iii. As ISO 9001 becomes more entrenched and expands in scope going forward, it is expected to exert modest downward pressure on LOROL's costs per customer served.
- iv. The strictures of meeting the concession requirements, including attaining ISO 9001, caused LOROL to focus on stopping errors before they occurred, rebalancing costs away from 'appraisal costs' toward 'prevention costs'. Improving timetabling and anti-graffiti measures constituted increased prevention costs, and decreased the appraisal costs associated with improving those areas after errors had occurred.

Points iii and iv are corroborated in the literature. Although the literature did not discuss the transport and telecommunications sector specifically, this indicates that LOROL's case study findings are typical of the experiences of other businesses. Corroborating point iii, Hannah's (2006) study on the effects of ISO 9001 indicates that the certificate exerts more impact on businesses' headline financial results the longer it has been in place. Point iv finds support in Beecroft (2000).

According to industry surveys, LOROL's customer satisfaction scores have risen substantially over the past four years, mainly due to the company's pre-existing quality culture and practices. The academic literature suggests that this finding is by no means uncommon: Reichheld and Sasser (1990), Farhoomand (2004) and the Health Foundation (2006) all find that QM systems improve customer satisfaction.

### 3.7.2 Case study 13

**COMPANY: TELEFONICA SA, TELEFONICA EUROPE, TELEFONICA UK (TRADING AS O2)**

**RESPONDENT: DAVID ROGERS, HEAD OF QUALITY FOR TELEFONICA EUROPE AND TELEFONICA UK**  
**PRINCIPAL SERVICE LINES: TELECOMMUNICATIONS, INTERNET AND INTEGRATED ICT SOLUTIONS**

This case study discusses how QM programmes have affected revenues, costs and employee satisfaction at Telefonica Europe and its subsidiary, Telefonica UK. The main focus is on the ongoing network improvement programme and ISO 9001 certification. In 2010, Telefonica Europe had 57 million customers, 30,000 employees and €15.26bn in revenues. Telefonica UK had 11,000 employees in 2009 and revenues of £2.97bn. The respondent was the head of quality for Telefonica Europe and Telefonica UK, and he reported having an in-depth knowledge of the QM mechanism employed by those businesses. He was also a fellow and quality professional of the CQI. QM across Telefonica has the following general features. Telefonica Europe uses the ISO 9001 framework to promote continuous improvement in country unit subsidiaries, empowering them to pursue their own QM programmes. ISO 9001 forms the crucial basis of most of Telefonica Europe and its subsidiaries', QM certification and methods. Telefonica UK would not be allowed to keep its Ofcom trading licence unless it maintained its ISO 9001 certification. In many cases, it is impossible to bid for corporate contracts without ISO 9001. Having ISO 9001 has enabled Telefonica Europe and its subsidiaries to bid for €3.4bn worth of contracts. All Telefonica Europe employees' and managers' remuneration packages are partially contingent upon meeting quality objectives. In 2010, Telefonica SA and its regional and national subsidiaries had a budget of €4.3bn to spend on R&D, innovation and network improvement.<sup>115</sup>

Telefonica UK's 2009 ongoing network quality drive has attained several achievements of particular interest:

- i. In 2009, Telefonica UK ascertained that its network had an unacceptably-high drop call rate. It used a portion of the 2010 Telefonica SA €4.3bn improvement and R&D budget to rectify this. Since 2009, quality has improved significantly, reducing the drop call rate. The Telefonica UK network is now ranked first for network quality by Ofcom.<sup>116</sup>
- ii. The 'Continuous Improvement' aspect of the programme sets gradually rising, achievable quality targets. This increased employee morale.<sup>117</sup>

The Head of Quality reported that Telefonica Europe's QM programmes, including network improvement, R&D and advertising, had achieved the following:

- i. Customer-retention rates were 2% higher in 2010 than they would have been had the programmes not been in place.
- ii. Assuming that customers are homogenous in aggregate, this suggests that revenues were 2% higher in 2010 than they would have been had the programmes not been in place. Based on the revenue data provided, and assuming that customers are homogenous in aggregate, this suggests that in 2010 Telefonica Europe's revenues would have been £305m lower than they actually were.
- iii. Customer-retention rates are expected to have increased three years from today, especially in the corporate and SME markets, implying that a significant part of QM mechanisms have their effects on outcomes (customer retention, in this case) after a lag of several years.

- iv. The network improvement programme caused an alteration of Telefonica Europe's cost structure, such that 'appraisal costs' declined relative to 'prevention costs'. By focussing on prevention, and so stopping costly problems before they get too far along the service delivery process, these programmes decreased appraisal costs, and the costs associated with rework and duplicate work.
- v. Telefonica Europe's QM mechanisms improved employees' understanding of their roles, responsibilities and objectives, thereby increasing their workplace satisfaction.

Points i to v were all corroborated by the papers in the literature, which have already been discussed. Although the literature did not focus on the transport and telecommunications sector, it suggests that these responses are typical of many businesses and not just peculiar to Telefonica Europe.

### 3.7.3 Conclusion to the transport and telecommunications sector case studies

The case studies in this section were broadly in agreement with each other and with the literature, suggesting that the findings reported by these businesses are typical of other companies in the transport and telecommunications sector.

Both reported that their QM programme had exerted at least some downward pressure on costs and rebalanced cost structures in favour of "prevention." Both had remuneration schemes or quality metrics in place which promoted management's commitment to the QM programme. Having such schemes and metrics in place follows from the literature, which suggests that management's active commitment is important to a QM programme's success. The findings imply that the QM mechanisms supported profits in both companies.

There were some points of departure between the companies' findings. One of them reported that its QM system had become effective with a lag and had exerted upward pressure on customer retention, just as the literature predicts. The respondent from the other company, LOROL, did not identify these effects. However, he noted that LOROL's gaining ISO 9001 followed easily on from its pre-existing quality procedures owing to similarities between them. Any similarities between ISO 9001 and the pre-existing procedures may have obscured ISO 9001's impact on customer retention and obscured the length of time it took to become effective.

## 3.8 Voluntary sector case studies

### 3.8.1 Case study 14

**INSTITUTION: MIND**

**RESPONDENT: PERRY MARSHALL, QUALITY MANAGER**

**PRINCIPAL SERVICES: COUNSELLING, RESIDENTIAL HOUSING AND SUPPORT, ADVOCACY AND LEGAL ADVICE, SOCIAL GROUPS AND CAMPAIGNING**

Mind is a UK mental health charity, comprised of a national central organisation and a network of over 180 affiliated Local Mind Associations (LMAs) in England and Wales. This case study discusses how Mind's QM programme affected the LMAs' turnover, volunteer satisfaction and quality of service provision since 2008. Each LMA is an autonomous affiliate of Mind, responsible for its own fundraising and services provision. Affiliation ensures each LMA meets Mind's service provision and governance quality standards. Each LMA provides some or all of the following services: counselling, residential housing and support, advocacy and legal advice, social groups and

campaigning. The whole 180-member LMA network achieved a 2011 turnover of just over £26.7m, and serves 250,000 people annually.

Mind's QM initiative is named the 'Quality Review Process' (QRP) which runs on a continuous four-year cycle, the most recent of which will end in June 2012. The QRP is based on the PQASSO quality process.<sup>118</sup> Under the QRP, each LMA assessed its performance against 12 standardised measures.<sup>119</sup> Then two independent reviewers verified each LMAs self-assessment by spending at least one day on site, and conducting a desktop review. The QRP is based on the PQASSO process, attributing each LMA a score of Level 1, 2 or 3. Level 1 requires meeting basic legal and health and safety benchmarks; Level 2 requires achieving a high standard of strategic planning; and Level 3 requires that the LMA has a leader within Mind's LMA network.

The Quality Manager reported that, in 2011, £350,000 was spent on QM by the LMAs, approximately 1.4% of their collective turnover. The QRP has yielded the following results:

- i. It has identified members of the LMA network which had not achieved the Level 1 minimum necessary standard. The process encouraged these underperforming members to work to attain the Level 1 standard, and those that consistently failed to meet the Level 1 standard were disaffiliated. These disaffiliations increased the average service provision and governance quality standards of the remaining LMAs in the network.
- ii. It fostered a culture of continuous improvement wherein LMAs self-motivate to progress up the Levels.
- iii. It encouraged LMAs to increase user involvement and inclusivity, thereby putting upward pressure on user-retention rates.<sup>120</sup>
- iv. By improving governance standards, the QRP has increased the average turnover of each LMA over the current cycle. The QRP is expected to continue increasing the average turnover of each LMA over the next three years.

Points ii, iii and iv suggest that Mind's experiences are typical of those other organisations which were discussed in the literature. Of particular interest is point iv, which notes that the QRP's effect on governance standards has improved financial performance. Several authors note that the impact a QM programme has on financial performance is dependent on management's commitment to the programme. Such authors include Deming, in *Out of the Crisis*, and Gallear and Ghobadian (2004), whose survey of businesses finds that management's leadership and vision are key preconditions of successful QM implementation. Building on these authors, point iv suggests that, in the case of Mind, the QM system itself improved governance. To the extent that this improvement increased management's commitment to the QRP, this will have made the QRP more effective.

The Quality Manager reported that the QRP has increased volunteer satisfaction by offering them better support and training. The respondent reasoned that this had caused volunteers to raise revenues more effectively, and so was partially responsible for increasing LMA turnover. Discussing the voluntary sector, the Centre for Voluntary Action Research at Aston Business School (2004) noted that effective QM programmes can increase volunteer satisfaction.

The LMAs devote significant effort toward implementing both appraisal and prevention mechanisms and, as predicted by

Beecroft (2000), the QRP has caused some rebalancing away from 'appraisal costs' and toward 'prevention costs' across the LMAs. However, this cost rebalancing has been only modest. The quality manager predicted that cost rebalancing would become more pronounced going forward, as more LMAs progress up through the three levels and rebalance their costs as part of that process.

### 3.8.2 Case study 15

#### INSTITUTION: A DEBT COUNSELLING CHARITY

#### RESPONDENT: CHIEF FINANCIAL OFFICER

#### PRINCIPAL SERVICES: DEBT COUNSELLING, DEBT SOLUTIONS

#### MISSION: To provide independent debt advice to over-indebted UK families and individuals.

This case study discusses how the QM programme of a UK debt solutions charity affected its turnover, efficiency, employee satisfaction and service quality since 2006. It had 866 full-time equivalent employees at the end of 2011 and revenues of £30.8m in that year.<sup>121</sup> The executive team is not financially rewarded for meeting quality-related targets.

As of 2006, the charity began implementing a QM programme aimed at enabling the charity to satisfy twice as many service users per staff member after the programme had been implemented, relative to before the programme had been implemented. The programme has five principal elements:

1. An internet portal was provided, allowing potential service users to input their debt data online. The internet portal was combined with a computerised 'decision logic' system which would give service users debt advice based on their data inputs.
2. The service user data input facility and the decision logic system were applied to the charity's telephone system.
3. Decision logic checks were introduced into counselling sessions, increasing the consistency of counsellors' decisions.
4. The telephone system was updated, allowing service users to talk with a debt counsellor over the phone as soon as they had put in the necessary data.
5. Management oversight mechanisms were updated. A monthly management pack summarises data and commentary on the performance of the charity's main functions, allowing management to track the effects of the QM programme and drive forward changes.

All elements of the programme were part of an organisation-wide approach to deliver useful and correct counselling solutions to service users. The programme's aim was also to increase the speed of counselling while reducing its costs, without compromising on service quality. These points indicate that the constituent parts of the programme fit with this report's working definition of QM. Elements 1, 2 and 4 had the following qualitative results, respectively:

- i. This saved charity employees time because they no longer had to collect service user data over the phone or during counselling sessions, and by reducing the need for counselling sessions.<sup>122</sup>
- ii. The result was that telephone workers would be able to gather service users' data, saving the time of highly skilled counsellors.
- iii. This saved time by enabling service users to provide data and complete their counselling, sometimes within an hour, comparing well with the pre-QM timeframe of several weeks.

The QM programme attained clear and impressive quantitative outcomes:

- i. The cost per service user counselled was reduced by 42% between 2006 and 2010 in money terms. Taking into account inflation, the charity had achieved a 48.4% reduction in costs per user counselled. Hence, the aim of satisfying twice as many service users per staff member after the programme had been implemented, relative to before the programme had been implemented, had been achieved in real terms.
- ii. The internet portal for data entry and automated 'decision logic'-based debt advice attracted service users of a new demographic, increasing revenues. Some 21,790 over-indebted individuals had taken up debt management plans through the online system by January 2012, representing approximately 20% of the charity's 'active' client base.<sup>123</sup>
- iii. In 2011, internet-based debt counselling yielded £6.7m of revenue, representing approximately 20% of revenue. The overwhelming majority of this would have been forgone had internet-based debt counselling not been provided, because service users would have gone elsewhere.<sup>124</sup> This echoes a key finding of the literature: successfully implemented QM programmes can drive up the number of service users and revenues. The literature which focuses on the voluntary sector specifically supports this point.<sup>125</sup>
- iv. The QM programme will increase the 'active' client base by 10,000 to 15,000 persons per year and a "large proportion" of that increase will result from the internet portal specifically. This point is in accord with those papers which found that QM programmes become more effective the more time they have had to bed in. For example, Hannah (2011) indicates that the longer the ISO 9001 certificate had been in place, the more it improved financial performance. Analogously, point iv finds that the QM programme increases the 'active' client base more, the longer it has been in place.

Finally, the programme increased employee satisfaction throughout the charity and this, in turn, reduced employee turnover rates and, therefore, costs.<sup>126</sup> This is consistent with articles focussing on the voluntary sector, and other sectors, which find that quality management systems improve employee satisfaction.

### 3.8.3 Conclusion to the voluntary sector case studies

There were several interesting differences between the case study findings of the two charities. There were also points on which they agreed but conflicted with the literature, suggesting that the literature's predictions do not always hold in the voluntary sector. In accordance with the literature's predictions, both respondents reported that their organisations QM system had increased service user retention (or driven up service user numbers) and had increased revenues, and employee and volunteer satisfaction. Only one organisation reported that its QM programme had lowered its costs.

One organisation reported that its QM programme had become effective with a lag. The other, Mind, reported a weaker version of this finding. Mind reported that its QM system became more effective at rebalancing costs toward 'prevention', the higher the level an LMA reached. This implies a lag in Mind's programme's impact on cost structures because of the time required for an LMA to progress up the levels. Notice this lagged effect only applies to the costs structure.

In conflict with the literature, Mind reported that cost rebalancing was relatively modest. The other organisation did not report any shift for 'appraisal' to 'prevention' costs due to its programme. The case study respondents agree that their organisations' respective QM programmes had little or no impact on costs structure, conflicting with the literature's expectation that a QM programme will rebalance cost structures. This suggests that the literature's prediction that a QM programme will rebalance the cost structure in favour of 'prevention' does not hold in the voluntary sector. By the same token, neither organisation gave a strong indication that management had been explicitly incentivised to further the QM programme. The literature suggests that management's commitment to a QM programme is essential to its success. The lack of incentivisation in both organisations could suggest that the voluntary sector incentivises its managers' commitment to QM programmes less avidly than other sectors. This could be because management's promotion of any given QM programmes is less important to its success in the voluntary sector than the literature expects.

### 3.9 Public sector case studies

#### 3.9.1 Case study 16

INSTITUTION: AN OUTER LONDON BOROUGH

RESPONDENT: CORPORATE PERFORMANCE MANAGER

THREE MAIN STRATEGIC PRIORITIES:

- i. "Providing better services with less money" – ie improving efficiency.
- ii. "Sharing opportunities, sharing responsibilities" – ie working alongside the local community and clearly communicating the council's responsibilities.
- iii. "A successful London suburb" – ie making the borough an enjoyable place to live and work, which is well regarded throughout London.

This case study focuses on how the QM mechanism of an outer London borough, which was instituted in April 2010, has impacted its "providing better services with less money" strategic objective. The QM system is part of the council's "performance management framework" and was implemented by its human resources (HR) department. The borough was in the top 10% of London authorities for its overall cost versus performance position in the second quarter of the 2010-11 financial year. The borough had a total net income of £620m in that financial year, and 3,200 employees on its direct payroll in 2011. The council measures quality outcomes against 70 quantifiable 'corporate plan' indicators, which are reviewed quarterly by a scrutiny committee and the council's senior management and political leadership. This ensures the senior management is able to drive continued quality attainment.

The 'corporate plan' indicators aid management's ability to oversee the QM programme and drive forward improvements. By ensuring that management remains committed to driving the programme forward, the 'corporate plan' indicators respond to the literature's concern that QM efforts will only prove effective if they enjoy management's active support. See Deming, *Out of the Crisis*, and Swiss (1992).<sup>127</sup>

The QM system uses quantifiable indicators measuring: (i) overall absence per staff member over the year; (ii) overall absence per staff member over the quarter; (iii) the percentage of managers submitting a monthly absence log for all employees under their jurisdiction; (iv) the percentage of staff who have objectives set at the start of the year; and (v) the percentage of staff who have the extent to which they have met

their objectives reviewed at the middle of the year.

The programme is a QM system implemented by the HR department. It affects all of the borough's staff and is, therefore, organisation-wide. By increasing workplace efficiency, it aims to decrease the cost of providing services to borough residents while maintaining service quality. The respondent noted that a key motivation underlying the system's implementation is cuts to public sector budgets. As such, the programme satisfies the report's working definition of QM: "an organisation-wide approach to... consistently delivering accurate solutions within budget."

Noteworthy cost-reductions and efficiency gains have been achieved:

- i. Metric iii has improved from 55% in the second quarter of 2011 to 74% in the first quarter of 2012.
- ii. Over the last two quarters, HR department data processing time, for the QM and 'corporate plan' indicators, has decreased by approximately 95%. Across the council, the time required to produce quarterly performance reports has fallen by 60% to 80%.
- iii. Council staff have come to view the quantitative metrics as being trustworthy, engendering a cultural change which has improved the council's ability to provide services efficiently.

These three points indicate that the programme has decreased the borough's costs. The literature suggests that these findings are typical of QM programmes' effects on public sector organisations. Cohen and Brand's (1993) findings are coherent with points i, ii and iii. Osseo-Asare et al (2007) and the Scottish Executive (2006) also find evidence that QM programmes reduce costs in UK public sector organisations.<sup>128</sup>

Improving metric iii has enabled the council to identify and better manage staff who are persistently absent, decreasing staffing costs per unit of service provided. Improving the metric has also removed persistently absent employees from the payroll, again improving cost efficiency. This effect is expected to become more pronounced as the council gets closer to attaining its goal of a 100% success rate for this metric. The QM system's ability to identify and remove persistently absent employees from the payroll increases over time. This chimes with the literature's prediction that QM mechanisms become more effective over time, or have their effects with a lag. Hannah (2011) and Hendricks and Singhal (2001) focus on QM's lagged effect on financial performance.

The 'corporate plan' indicators, which are a means of managing quality, had facilitated a cost structure shift which reduced 'appraisal costs' versus 'prevention costs' throughout the council. This was predicted by Beecroft (2000). Implementing the indicators constitutes increasing prevention costs and led to a decrease in appraisal costs by improving early intervention measures. This maintained service quality as budgets have been tightened. Alterations to council services provision also furthered changes to the council's costs structure. For example, the council's pre-emptive provision of mobility-enhancing products to the elderly reduces the probability that an elderly person will fall. This helps elderly council residents remain healthy while avoiding costly stays in hospital. This is analogous to decreasing the appraisal costs associated with caring for the elderly.

### 3.9.2 Case study 17

**INSTITUTION: CABINET OFFICE**

**RESPONDENT: HEAD OF PERFORMANCE AND MANAGEMENT INFORMATION**

**SERVICE LINES: IMPROVING THE EFFICIENCY OF CIVIL SERVICE DEPARTMENTS**

This case study examines how a principal organ of the UK Cabinet Office (CO), the Efficiency and Reform Group (ERG), has impacted spending efficiency across the UK Civil Service (CS). In 2011, the CO had c.1,500 employees, and the CS had an expenditure on pay and pensions of around £110bn and around 430,000 employees. The ERG came into existence in May 2010.

In 2011, the ERG's QM mechanism was the measurement of cash savings across the portfolio of CO programmes, aiming to assist all CS departments in spending their funds as efficiently as possible. By improving CS departmental efficiency the mechanism assists them in reducing their spending, helping to tackle the structural deficit and maintain service quality. The programme facilitates CS spending reforms while promoting economic growth. The main CS work areas affected are: centralising procurement; marketing and media; streamlining the CS; major projects; government IT and government property management. The most senior managers monitoring the work are the Permanent Secretary and the Minister for the Cabinet Office. The programme will continue throughout this Parliament.

The ERG programme derives "strong quality metrics" for use across all work areas. Each area has a trajectory of savings which it is expected to meet. The savings reported by the different delivery areas are audited and subjected to monthly review. This external review and audit process encourages the units to meet their trajectories and to report their progress accurately. Under the mechanism, the CO supports CS departments in embedding the following management philosophies into their daily operations where appropriate: Six Sigma, Lean and Continuous Improvement mechanisms. For example, the CO has worked with HMRC on integrating Continuous Improvement mechanisms into their tax collection activities to reduce costs and improve quality of tax collection.

The Head of Performance and Management Information reported that:

- i. The programme had supported CS departments in making £3.75bn of savings in 2011, a 3.4% efficiency gain and beating the £3.2bn aspiration.
- ii. The Cabinet Office hopes CS departments will benefit by at least £3.75bn in 2012, and beyond.
- iii. In 2011, the programme had reduced unnecessary consultancy hire by CS departments, saving £870m.
- iv. The ERG's rigorous quantitative oversight has encouraged the Major Projects Authority (MPA) to increase project management efficiency.<sup>129</sup>

Points i to iv are typical of those elements of the literature which suggest that public sector organisations can lower their costs through effectively implementing QM programmes.<sup>130</sup> However, these points have a broader scope than the papers. While the papers examined how QM can reduce costs in the cases of individual public sector organisations, points i to iv indicate that the CO's ERG programme had reduced costs for the many separate public sector organisations in the CS.

The Head of Performance and Management Information cautioned that early successes tend to derive from "low-hanging fruit" and that where systemic reform is not achieved, gains can be front-loaded. It is not yet possible to identify cases wherein particular CS departments have not achieved systemic reform, causing front-loaded gains. Such cases, if they are found to have occurred, would conflict with the literature's finding that QM programmes have more of an impact the longer they have been in place.<sup>131</sup> If this were the case, the outcomes of the ERG programme would not entirely accord with the literature's findings.

The respondent reported the CO had rebalanced costs away from "appraisal costs" and towards "prevention costs" procedures across the CS in 2011. This response agrees with the expectations of the literature. By enabling the CS departments to catch problems up front at the planning stage, the CO stops costly problems before they affect service delivery. Hence, less was spent on appraisal after (or as) services were being delivered by CS departments. The respondent predicted this effect would hold going forward.

The ERG's programme improved employee welfare throughout the CS by helping civil servants to operate more efficiently, decreasing the effort they needed to exert to get a given level of output. It is reasonable to infer that this improved employee workplace satisfaction, agreeing with the literature's expectations as to the effect of QM mechanisms.

### 3.9.3 Conclusion to the public sector case studies

The public sector organisations' case study findings are in almost complete agreement with each other and cohere with the literature's predictions. This suggests that these case study responses are representative of the experiences of other public sector institutions.

Both respondents found that the QM programmes had lowered costs and facilitated a change in cost structures toward 'prevention' costs. Both indicated that managerial commitment was important to the success of the organisation's QM programme and that the programme became more effective with a lag. Only one organisation confirmed that the programme had increased workplace satisfaction.

### 3.10 Quality excellence body case study

#### 3.10.1 Case study 18

**INSTITUTION TYPE: QUALITY EXCELLENCE BODY**

**RESPONDENT: CHIEF EXECUTIVE**

**MISSION OF THE QUALITY EXCELLENCE BODY:**

The excellence body assists businesses in improving outcomes and performance across all their departments, and product or service delivery lines. The body aims to help businesses improve customer and client satisfaction; efficiency; employee motivation; teamwork practices and overall strategy.

Expanding from the single organisation focus of the previous case studies, the final case study discusses the QM findings experienced by a large number of businesses. This case study focuses on how Lean, as applied to processes, has affected outcomes for business services firms in a particular region of the UK according to the Chief Executive of an excellence body. The Chief Executive has knowledge of the effects of Lean, as applied to processes, on these businesses' outcomes and agreed to share it.

Although it is not the focus of the discussion, the excellence body is described to contextualise the discussion. The body had a 2011 turnover of £1.9m and had 10 employees on average that year. For the year ending March 2011, the body had worked with 830 organisations. The institution is most active in the UK, from where it sources some 95% of its revenues, and 73% of its customers are from the focus region of the UK where the body's predominant focus lies.

The respondent explained that, in 2011, 75% of business services firms in the excellence body's focus region, who were also working with the excellence body, were instituting or using Lean applied to process efficiency. These methods increase service delivery efficiency by removing wasted steps or needless inputs at the various stages of the service delivery process.<sup>132</sup> He also explained that, in the focus region, a business services firm will typically identify a need to increase cost efficiency due to "external pressure" – such as customers demanding lower prices – or "internal pressure" – such as board members demanding efficiency gains. The business will then focus on streamlining its processes by implementing Lean. In the post-2008 economic climate, business services firms in the focus region have often implemented Lean in response to foreign "external pressure." In 2011, the Chief Executive estimated that across all business services firms in the focus region, an average of approximately 1% of revenues was spent on QM systems. Furthermore, he estimated that 0.05% of revenues were spent on Lean as applied to processes.<sup>132</sup>

In the focus region, for 830 business services firms working alongside the excellence body, the implementation of Lean as applied to processes was found to have yielded substantial Return on Investment (RoI) benefits:

- i. For the 830 business services firms, over the last seven years, there has been an average RoI of 19:1. One firm made a £18,000 external investment and achieved £900,000 worth of cost savings, a Cost RoI of 50:1.<sup>134</sup>
- ii. Three years from now, as general trend, this RoI effect is expected to become more pronounced.<sup>135</sup> This is because many firms have only recently begun implementing the process, so there are still many comparatively easy efficiency gains to be achieved.
- iii. These increased RoI benefits will only be realised if business managers remain committed to the implementation of Lean programmes.<sup>136</sup>
- iv. The RoI benefits which these 830 business services firms have enjoyed are comparable to those arising from other business improvement techniques, such as cloud computing. The implementation of cloud computing can reduce costs significantly. However, the RoI benefits of cloud computing can be variable, with some institutions experiencing significant cost reductions while others experience more modest gains.<sup>137</sup> The same is true of QM: some businesses reported very significant RoI cost reduction gains as a result of implementing QM programmes, others reported less pronounced RoI benefits. In one important regard, which follows, the evidence suggests that implementing QM procedures benefits organisations more consistently than moving to a cloud computing platform. All the organisations in this report (which provided relevant data) indicated that implementing a QM programme reduced business costs by more than the cost of instituting their QM system. However, 13% of respondents in Schwartz (2011) did not expect to achieve a net reduction in costs if they were to move to

a cloud computing platform from their current platform. Overall, QM programmes can probably reduce costs for all organisations – however, for some organisations, a move to cloud computing might actually raise costs.

These RoI results are impressive and suggest that businesses can expect to achieve cost savings which significantly outweigh the costs of QM implementation, if they choose to implement Lean programmes.

The respondent indicated that employee satisfaction had improved because of the waste reduction which the implementation of Lean programmes caused. This response, which applies to the many businesses that the respondent was discussing in general terms, is also supported by the literature. This suggests that the businesses which the respondent was discussing were not atypical of businesses in general.<sup>138</sup>

The Chief Executive reported that the implementation of the Lean programmes applied to process efficiency had not caused a cost rebalancing away from "appraisal costs" and towards "prevention costs" for business services firms in the focus region. This does not agree with a key prediction of the literature (see Beecroft 2000). He added that such a cost rebalancing had occurred, although, instead of being caused by the implementation of Lean processes, it had been caused by the stresses of the post-2008 economic climate.

#### References

68. *These eight sectors are: manufacturing, defence engineering, engineering and construction, legal services, business services, transport and telecommunications, the voluntary sector and the public sector. There is also an additional case study provided by a quality excellence body.*
69. *In some cases, the findings of a particular case study may not follow the general theme of the literature. This does not indicate any error on the part of the respondent; it simply indicates that his or her organisation is not typical of the literature as a whole. The points of divergence between the case studies and literature review, where they do occur, simply suggest that some of the organisations which provided case studies were not typical of those which had been investigated by the authors of the papers in the literature review. Cebr simply examines how far the case studies are coherent with the literature, rather than attempting to arbitrate between them.*
70. *Only those sector subsections containing more than one case study have concluding sections at the end.*
71. *For all case studies, except case study 18, the inferred RoI estimates were not provided by the respondents; they were estimated by Cebr. Every effort has been made to ensure the accuracy of the RoI calculations.*
72. *This estimate assumes the annual costs of the IPC programme are constant.*
73. *The respondent did not identify which process control aspects of the IPC programme were responsible for the reductions in per-unit costs.*
74. *This reduction in post-production per-unit test times was only given in terms of a percentage decline in production costs by the respondent.*
75. *The respondent did not disclose what SPS stood for.*
76. *The respondent did not quantify this reduction in hours.*
77. *Consumer homogeneity is a standard economic assumption. It implies that, in aggregate: (i) each consumer (who chooses*

- to buy from Smith's Environmental) spends the same amount as other consumers on the company's products; and (ii) each consumer would have been equally likely to stop purchasing from Smith's Environmental if product quality had been low in 2011.
78. 'Prevention costs' are planned costs to ensure that errors are not made at any stage of the delivery process of a product or service. 'Appraisal costs' are the costs of checking/verifying a product or service at the various stages during its delivery process.
  79. The respondent did not reveal how long the pilot aspect of the programme has been in place for.
  80. This statement follows from statistical theory. Namely: for any one variable, the lower the in-sample variance, the greater the probability that that variable's in-sample mean is close to its population mean. See: Wooldridge (2002), *Introductory Econometrics: A Modern Approach* (2nd Edition).
  81. Crosby (1979), *Quality is Free*, McGraw Hill.
  82. The respondent quoted that the total stand-alone cost of the initiative was 0.005% of average annual revenue for November 2006 to November 2011.
  83. For further detail, see Davenport and Short (Summer 1990), 'The New Industrial Engineering: Information Technology and Business Process Redesign', *Sloan Management Review*, p. 11–27.
  84. The respondent did not reveal whether this finding was a result of an employee survey by Selex Galileo or some other method of analysis.
  85. Owing to confidentiality requirements, the report cannot disclose more about the business or its principal client.
  86. The BIPs typically focus on project improvement in the areas of: leadership, vision, strategy, staff competency, supply chain relations and communicating to employees.
  87. The respondent did not explain how these processes played into QM. One can reason that the continual cycle of PPA and BIP gradually improves processes, and that cycle helps to weed out inefficient steps in service or product delivery. These are 'Continuous Improvement' and 'Lean as applied to processes', respectively.
  88. The respondent was unable to quantify these effects.
  89. Betterment is a project's final margin less its tender margin.
  90. See Reichheld and Sasser (1990) and (on the closely-related metric of market share) Cole and Flynn (2009).
  91. The respondent did not disclose the exact cost of his business's QM programme, only indicating that it was well under 1% of revenues.
  92. See Hannah (2011) and Hendricks and Singhal (2001).
  93. Based on the case study evidence, these rapid impacts apply only to the legal services sector. Later case studies find some evidence that QM programmes impact outcomes comparatively rapidly in the business services sector (see subsection 3.6). However, this evidence is weaker than for legal services. As such, the case studies in subsections 3.5. and 3.6 do not provide sufficient evidence to conclude that QM programmes have their impacts comparatively rapidly across all service type businesses, relative to non-services businesses.
  94. 'Prevention costs' are planned costs to ensure that errors are not made at any stage of the delivery process of a product or service. 'Appraisal costs' are the costs of checking/verifying a product or service at the various stages during its delivery process.
  95. This result was predicted in the academic literature. See Beecroft (2000).
  96. For instance, they track 'Bar Mark' performance. The independently administered and audited Bar Mark is a quality performance metric which is designed to track management quality performance in chambers. It is divided into six areas and is evaluated on a monthly, quarterly and/or annual basis.
  97. The positive effect on customer retention rates agrees with the literature. See Reichheld and Sasser (1990).
  98. This effect is called 'diminishing returns'.
  99. Both legal services respondents indicated that their businesses' QM programmes has decreased costs and/or increased revenues. It follows logically that their QM programmes increased business profits.
  100. The company provides IT services mainly to legal services firms.
  101. This inference relies on the standard economic assumption that customers are homogenous in aggregate. See subsection 3.2.2 (case study 2) for a discussion of this assumption.
  102. ISO 9001 requires: (i) strong managerial quality leadership; (ii) that quality is actively pursued by the workforce; (iii) quality decisions that are data-based; (iv) that quality systems are regularly audited; (v) that quality systems are tailored to customer requirements and (vi) that the business has robust procedures for rectifying errors. Attaining and maintaining independently-verified ISO 9001 certification acts as a guarantee that a business' processes have attained a high degree of quality. See ISO 9001:2008 Quality Management System – Requirements. [http://www.iso.org/iso/catalogue\\_detail?csnumber=46486](http://www.iso.org/iso/catalogue_detail?csnumber=46486)
  103. By and large, the respondent did not reveal quantitative estimates of the impacts of PMD Healthcare's QM system.
  104. Points iv and v are consistent with the literature.
  105. See Collins and Nussey (1994).
  106. The respondent did not quantify these effects.
  107. The 'Waterfall' system is an iterative software development process. The software travels sequentially through the phases of requirements, design, implementation, verification and maintenance. There is minimal feedback between the different process steps. See: Benington (1983), 'Production of Large Computer Programmes', *IEEE Annals of the History of Computing (IEEE Educational Activities Department)* 5(4), pp 350–361.
  108. The 'Iterative Lifecycle' process is a software development process involving a high degree of feedback between its different stages. Once a piece of software has undergone an initial iteration of being designed, produced and tested, its design may be altered in light of the test results. This process may be repeated several times. See: Dr. Cockburn (2008), 'Using Both Incremental and Iterative Development', *STSC CrossTalk*, 21(5), pp 27–30.
  109. The respondent was unable to provide quantitative estimates of the results listed below.
  110. The last was India, where it is currently being implemented.
  111. Preventative actions are those that ensure that errors are not made at any stage of the delivery process of a product or service. Corrective actions are those that verify a product or service at the various stages during its delivery process.
  112. The business services sector case studies only provide weak evidence that QM programmes improve outcomes comparatively rapidly in that sector. By contrast, the legal services sector case studies (subsection 3.5) provide strong evidence that QM programmes improve outcomes comparatively rapidly for legal services firms. Because the evidence for business services firms is comparatively weak, subsections 3.5 and 3.6 do not warrant the conclusion that

- QM systems impact businesses' outcomes comparatively rapidly across all service sector companies.
112. 'Prevention costs' are planned costs to ensure that errors are not made at any stage of the delivery process of a product or service.
  113. LOROL has also attained ISO 18001 and ISO 14001, relating to safety management and environmental standards management, respectively.
  114. For example, LOROL faces penalties for failing to meet targets for graffiti and gum removal, train punctuality, accurate train timetables, accurate information displays, customer satisfaction, and train and station cleanliness.
  115. Telefonica SA is the global parent company of Telefonica Europe and other regional Telefonica companies.
  116. Network quality is declining as problems such as drop call rates, jittery sound transmission, congestion and intermittent coverage become more pronounced. See Visualdata (2011), 'TRAI Performance Indicators Quality of Service Report' Q4 2010 – Part 1.
  117. This point agrees with predictions in the literature. See Farhoomand (2004).
  118. PQASSO is a self-assessment quality standard designed for use in the voluntary sector.
  119. The respondent did not list these 12 measures. However, given that QRP is based on PQASSO, it is reasonable to infer that these may be the same as 12 PQASSO measures: planning, governance, leadership and management, user-centred service, managing people, learning and development, managing money, managing resources, communications and promotion, working with others, monitoring and evaluation, and attaining results.
  120. The respondent did not know what the user retention rate would have been had the QRP not been instituted. As such, he did not quantify the extent to which the programme had increased user retention.
  121. The charity's associated individual voluntary agreement debt management and insolvency vehicle had additional revenues of £2.2m in 2011.
  122. The respondent did not quantify how much time Elements 1, 2 and 4 saved.
  123. 'Active' service users are those who maintain regular debt repayment under the charity's debt management programme.
  124. The charity gets 'fair share contribution' revenue from the credit industry by arranging debt management plans for over-indebted households, allowing the credit industry to avoid losses it would otherwise have incurred.
  125. See Centre for Voluntary Action Research (2004), *The Adoption and Use of Quality Systems in the Voluntary Sector: Final Report*.
  126. The respondent did not quantify this effect on employee satisfaction.
  127. Swiss (1992), 'Adapting Total Quality Management (TQM) to Government', *Public Administration Review*, 54, pp. 356-362.
  128. Bear in mind that removing persistently absent employees from the payroll is a means of improving financial performance.
  129. The CO runs the MPA which administers, reports on and provides assurance for all projects or programmes which require HM Treasury approval. The ERG has an oversight role in quantifying the value of MPA's projects and quality improvement programmes.
  130. See Cohen and Brand (1993), Mani (1995) and the Scottish Executive (2006)
  131. See Hendricks and Singhal (2001), Hannah (2011) and Cole and Flynn (2009).
  132. See the Scottish Executive's (2006) report on Lean in the Scottish public sector.
  133. He caveated that these figures were not exact because not all firms reveal their expenditures on either (i) Lean programmes and/or (ii) other QM programmes.
  134. The respondent did not identify any individual business by name. He did not disclose how these impressive RoI achievements compared to businesses' other value adding activities.
  135. The respondent did not estimate what proportion of businesses would see this RoI effect become more pronounced.
  136. This caveating point echoes a key theme of the literature, which has already been discussed.
  137. Schwartz (2011), 'Cloud computing can generate massive savings for agencies', *Federal Computer Week* and Salam (2012), 'RoI (return on investment) from cloud computing', *CloudTweaks*, <http://www.cloudtweaks.com/2012/06/roi-return-on-investment-from-cloud-computing/>
  138. The respondent did not cite any survey evidence to support this result.

## 4 SURVEY: REPORTED IMPACTS OF QUALITY MANAGEMENT ON BUSINESS OUTCOMES

### 4.1 Survey introduction

CQI commissioned Opinium to survey 120 senior business professionals across a range of sectors to assess the impacts of QM on business performance. The Opinium survey also examined how far businesses have measures in place to incentivise senior management to drive forward QM programmes and how much businesses plan to invest in QM in the future. The survey was conducted in the final quarter of 2011. This section of the report outlines the key findings of this survey<sup>139</sup>. In accordance with the first objective of our study, this section attains results as to the impact of QM programmes on business outcomes. Overall, the survey suggests that:

1. QM programmes can yield significant cost savings to businesses.
2. Most businesses agree that QM is an important driver of success that allows them to better retain customers and justify price premiums on products.

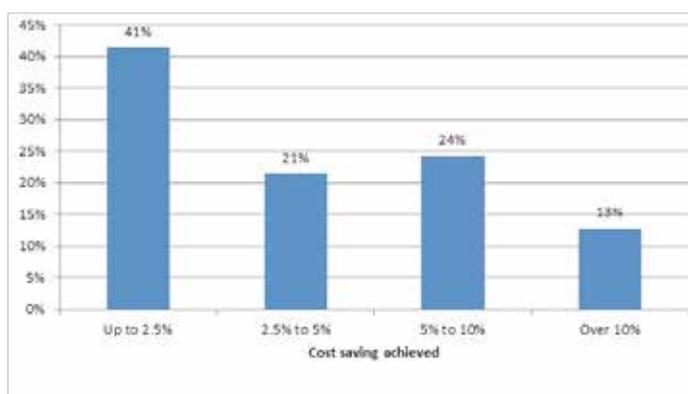
This section of the report builds naturally on the literature review and case study evidence. It was beyond the scope of this survey to analyse all of the issues the literature review touched on. The aim of the survey was to attain evidence relating to two of the most important topics discussed in the literature review – namely, QM's effects on costs and on overall business success. At the conclusion of this section, the survey's principal findings are compared with those of the literature review.<sup>140</sup> The predictions of the literature review are found to be supported by the survey evidence.

### 4.2 Survey results and discussion

Figure 1 below shows the cost savings achieved by businesses as a result of efforts to improve quality.

Figure 1: In your estimation, what magnitude of cost savings has your business been able to achieve as a result of your efforts to improve quality? Distribution of survey results

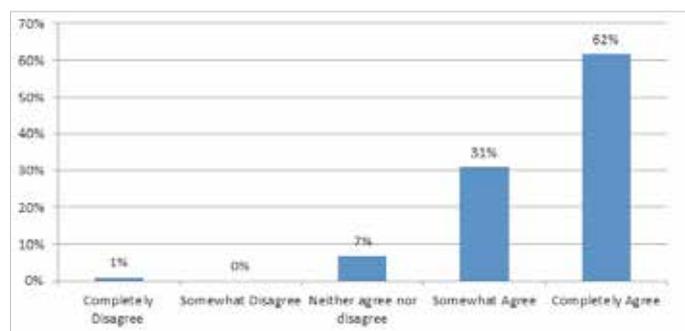
Source: Opinium Survey



On average, for firms that have successfully deployed quality programmes, costs are estimated to be 4.8% lower than they would otherwise have been, suggesting that QM programmes can provide significant cost savings to businesses. Almost all survey respondents (93%) agreed that QM is a significant success driver in their industry, as shown in Figure 2 below.

Figure 2: Successful quality management is an important driver of business success in my industry – agreement with statement

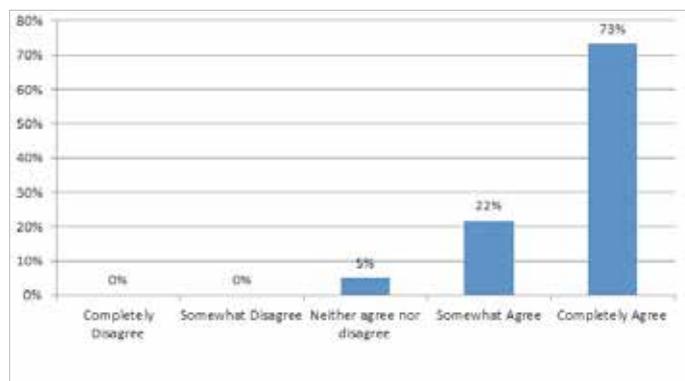
Source: Opinium Survey



Businesses believe that QM contributes strongly to customer satisfaction and therefore retention, with about three-quarters of those interviewed “completely agreeing” with this notion. This is illustrated in Figure 3 below.

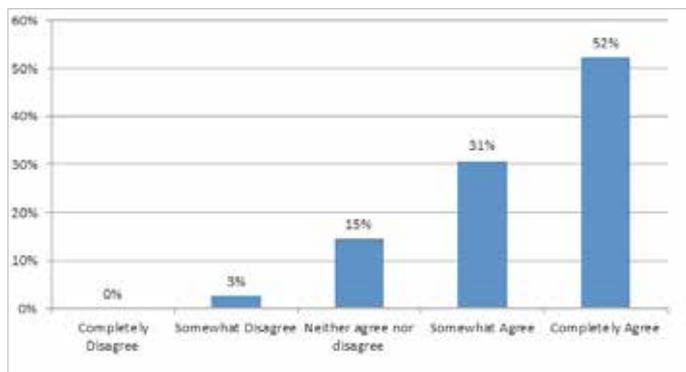
Figure 3: Good quality management contributes strongly to customer satisfaction and therefore retention – agreement with statement

Source: Opinium Survey



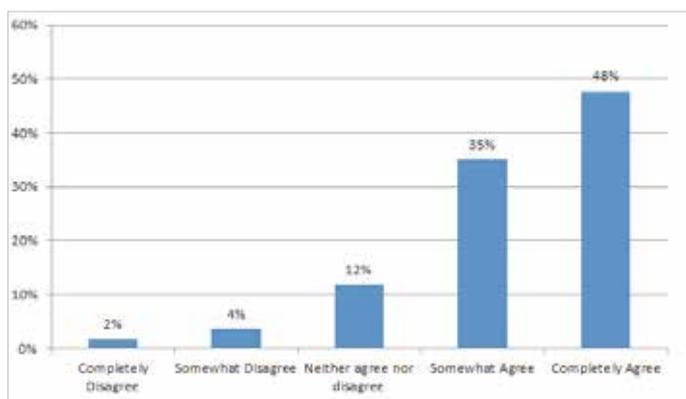
Companies also perceive a strong association between productivity and QM – over 80% of respondents agreeing with this proposition, as shown in Figure 4 below. This suggests that, for most businesses, QM can increase the amount of revenue generated per employee within the firm.

Figure 4: My company's quality management system allows for consistent improvement in processes, thereby improving productivity – agreement with statement  
Source: Opinium Survey



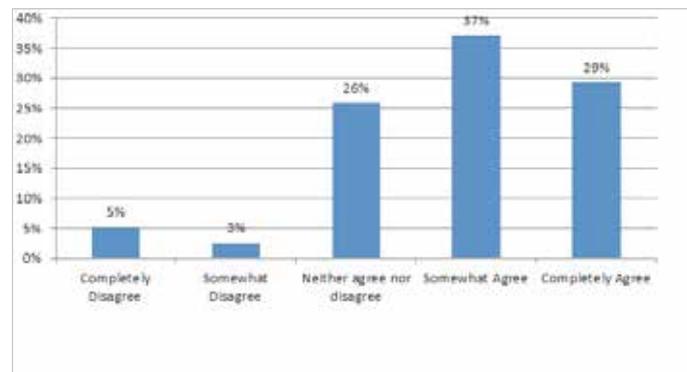
Furthermore, most firms (83%) agreed that the achievement of quality helps justify the price premium firms can charge on products, helping them to maximise profits, as Figure 5 illustrates.

Figure 5: I would find it difficult to justify the price I currently charge for my product if the consistency of product delivery were lower than at present – agreement with statement  
Source: Opinium Survey



Overall, therefore, the Opinium survey suggests that QM plays an important economic role – helping firms to retain customers, justify price levels and improve productivity. Furthermore, the survey suggests that the perceived importance of achieving quality standards is growing – about two-thirds of respondents believed that the consequences of not meeting quality goals would be higher in the future than they are now, as Figure 6 illustrates. Over 70% of firms surveyed believed that realising productivity improvements via their QM systems was a strategic imperative and over two-fifths (41%) of companies believed that pursuing operational efficiencies, possibly linked to quality, could provide a better way of achieving earnings growth than sales expansion in the current economic climate.

Figure 6: I believe that the negative consequences to my company from failure to attain quality management goals will be more serious in the future than at present – agreement with statement  
Source: Opinium Survey



Despite widespread agreement on the economic benefits of QM implementation, the majority of businesses did not have firm plans to increase investment in QM going forward. Just 37% agreed with the statement “my company intends to increase its investment in QM systems in the future compared with the amount it invests today.” See Figure 7. Furthermore, only 31% indicated that their executive team is financially rewarded for successfully meeting quality-related objectives. This is illustrated in Figure 8.

While, at first glance, these results may seem surprising, they do not directly conflict with the literature reviews findings. With regard to the data in Figure 7, the literature does not state that businesses will perpetually increase their QM investment going forward. Investing in QM is only one of a business’s possible investment strategy options. Given that companies have finite resources, increasing investment outside of QM, while forgoing an expansion of QM investment, may be appropriate at times.

Regarding the findings of Figure 8, the literature often reports that the effective implementation of QM programmes requires the commitment of senior management. However, it does not state that financially rewarding the executive team for QM successes is a precondition of attaining their commitment to QM programmes. For example, a business culture in which there is a strong emphasis on quality can, itself, be sufficient to garner senior executives’ commitment to a QM programme.<sup>141</sup>

Linking back to the case studies (see section 4), respondents often reported that senior executives were financially rewarded for overall business success. Respondents tended to reason that, even though these financial rewards were not directly linked to QM successes, they were sufficient to bring about senior executives’ commitment to successful QM programme implementation, because QM success fed into successful business outcomes. Hence, an incentive structure which rewards executives for general business success can encourage their commitment to specific QM success. This incentivisation channel, identified by the case studies, was not investigated for Figure 8.

Figure 7: My company intends to increase its investment in quality management systems in the future compared with the amount it invests today – agreement with statement  
 Source: *Opinium Survey*

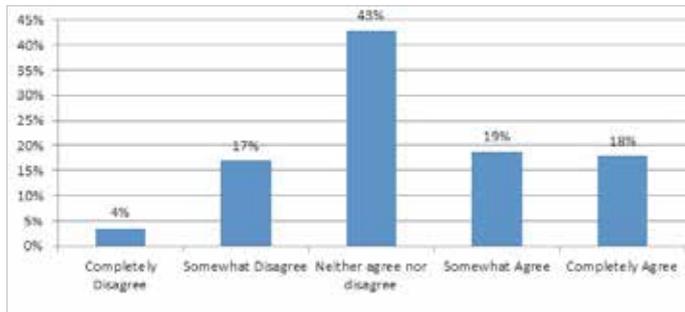
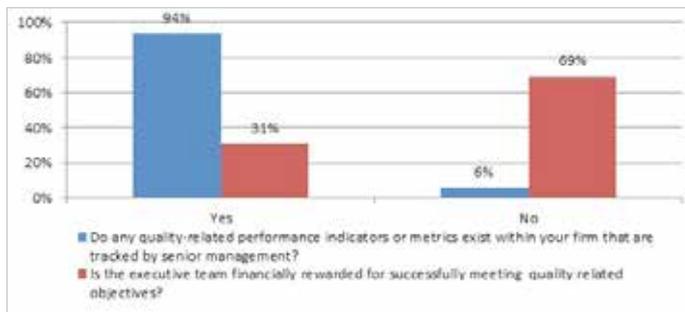


Figure 8: Distribution of survey responses, by question  
 Source: *Opinium Survey*



### 4.3 Conclusions on the survey findings

The survey data yield two principal findings:

1. QM programmes can result in significant business cost savings. This finding was observed from the data in Figure 1.
2. QM is often perceived as being an important driver of success that allows businesses to better retain customers and justify price premiums on products. This finding is suggested by the data in Figures 2 to 6.

These survey findings cohere with the findings in the literature. The first finding is supported by Levine and Toffel (2010), Scottish Executive (2006), Osborne and Gaebler (1992), and others which found evidence that QM systems drive down costs for public and private sector institutions. (See the literature review in section 3). The second finding is more general and is supported by a large number of papers from the literature review. Hendricks and Singhal (2001), Hannah (2011) and Farhoomand (2004) all find evidence that the implementation of QM programmes can push up stock prices – a key measure of overall performance for many businesses. Similarly, these papers: Reichheld and Sasser (1990), Oliver and Qu (1999) and others found that QM systems can improve overall financial performance and profits – another key metric of business success.

Relating to the second principal finding above, several papers from the literature review find that QM systems improve customer or service user satisfaction and retention. This result held in the private sector – see Farhoomand (2004), and Reichheld and Sasser (1990). It also held in the public sector – see McAdam, Reid and Saulters (2002) and the Health Foundation (2006). Finally, it is also supported by those sections of the literature which discuss the voluntary sector. For example, the Centre for Voluntary Action Research at Aston Business School (2004) found that QM procedures can improve service user satisfaction for voluntary sector organisations.

### References

139. In the analysis which follows, survey respondents who answered 'don't know' to a question or refused to answer a question have been omitted.
140. Toward the end of this section, some of the survey's findings are also discussed in the context of information provided by the case studies (section 4).
141. See Gallear and Ghobadian (2004).



# 5 MODEL: ESTIMATED IMPACTS OF QUALITY MANAGEMENT ON HEADLINE UK ECONOMIC INDICATORS

## 5.1 Introduction to the model

In accordance with this report's second aim, this section provides quantitative estimates of the extent to which more effective, intensive and longer-term use of QM systems and techniques can be expected to affect headline UK macroeconomic indicators. To further this end, Cebr developed a bespoke economic model with the purpose of formulating estimates of the effects of QM on: (i) GDP, (ii) employment, (iii) net Exchequer tax receipts (or net benefit to the Exchequer)<sup>142</sup>; and (iv) sectoral production technology.<sup>143</sup>

Having just described the model's purpose, this subsection goes on to explain the modelling framework and, thereafter, discusses the quality of the data which the model uses as inputs. We highlight that the data is likely to be a close reflection of economic reality and that, consequently, the model's estimates of the impacts of QM on UK macroeconomic indicators are also likely to be good approximations of the economic reality. The reasons why this modelling methodology, as opposed to any other tool of economic investigation, has been employed are then discussed. The following subsection gives an in-depth description of the modelling method and discusses how the model's key inputs were derived. The model's limitations are discussed in this subsection and the following subsection. The model's assumptions are also discussed in the following subsection.

Cebr's bespoke economic model comes toward the end of the report because it builds on data provided by the literature review, case studies and survey. It uses these data as inputs to formulate estimates as to the impact of QM on the aforementioned UK headline macroeconomic indicators.<sup>144</sup> Hence, the model does not provide 'real world' evidence *per se*, rather an assessment of what can be expected to be the impact of QM under certain sets of assumptions and inputs.

In lieu of being able to provide real world evidence in its own right, the model utilises the real world evidence provided by the preceding sections in the following analytical framework. The model employs the empirical evidence to estimate the values that the headline UK economic indicators – (i) GDP, (ii) employment, (iii) net Exchequer tax receipts; and (iv) sectoral production technology – can be expected to take under two counterfactual scenarios. Intuitively, the first counterfactual scenario considers a situation in which no public, private or voluntary sector organisation had implemented any QM programme at all. Intuitively, the second counterfactual scenario captures a situation in which all organisations have implemented QM as fully as possible. These situations are called Counterfactuals One and Two, respectively. Discussions in the latter half of subsection 5.2 explain how Counterfactuals One and Two are defined rigorously

with reference to this report's working definition of QM.

The values of (i) to (iv), above, under the Counterfactuals are compared to their values under a Baseline Scenario which reflects each sector's intensity of QM implementation as it actually is in reality for each year of the study period. For now, note that comparing the values the four indicators take under Counterfactual One against their actual current values (under the Baseline Scenario) provides estimates of how far QM programmes have already positively impacted on UK macroeconomic indicators. Comparing the values the indicators take under Counterfactual Two against the values they take in actuality, provides estimates of how much potential QM has to improve UK macroeconomic indicators if it were rolled out as fully as possible.

The modelling analysis and the associated counterfactual scenario comparisons take place for each year of the 2009-13 study period in order to estimate QM's effects on headline UK macroeconomic indicators in the recent past, present and near future.

The model's estimates for 2011 are the main subject of the discussion, because an analysis of this year gives the most up-to-date estimates of QM's impacts on the UK economy. To ground the 2011 estimates in the recent past and near future, figures detailing the model's estimates for each year of the 2009-13 study period are also presented. To provide additional context, estimates for a 'typical' year are also provided.

The model's first limitation is that the estimates it yields will only be as good as the inputs used to produce them. This limitation applies to all economic models which, like this model, estimate the impacts which one variable has on other variables under a certain set of assumptions and conditions. This limitation is unavoidable. Consequently, four points are of note:

- i. Because the model is reliant on inputs from the literature review, case studies and survey, the estimates of the effects of QM on headline UK economic indicators will only be accurate to the extent that inputs from the literature review, case studies and survey are reflective of reality.
- ii. The inputs into the model were drawn from a comprehensive examination of empirical evidence provided by the QM literature, 18 case studies, and a survey of 120 organisations. This constitutes a large evidence base. It is, therefore, not unreasonable to assume that the estimates produced by the model are a close approximation of the economic reality.
- iii. Cebr's bespoke economic model makes use of the QM input data and publically available macroeconomic data on GDP, employment and taxation, which is provided by the Office for National Statistics (ONS). These official ONS statistics, when

used as data inputs, are likely to match well with reality.

iv. Where one accepts that the input data for Cebr's bespoke economic model are close estimates of economic reality, the model's estimates of the impacts of QM on UK macroeconomic indicators under both counterfactual scenarios, are likely to be good matches with QM's real impacts. The real impacts of QM under both counterfactual scenarios cannot be directly observed, which is why Cebr's model estimates them.

The two reasons why this modelling methodology, as opposed to some other analytical method, has been employed are now discussed.

Cebr believes that the use of this modelling methodology will yield the most accurate possible estimates of QM's impacts on headline UK macroeconomic indicators. Points ii, iii and iv (above) explain why Cebr believes this modelling methodology will yield estimates of QM's impacts which are likely to be a good match with QM's real impacts.

We would expect, therefore, that other methods would likely produce estimates that would have reflected reality less accurately than the framework we employed. The only other widely-employed tool of empirical economic estimation, besides Cebr's chosen economic modelling framework, is econometric regression analysis. Regressions are a workhorse estimation method in empirical economics, and courses in regression analysis are a staple of most British undergraduate economics courses.

Put simply, regression analysis works as follows. First, an economist will find a dataset containing data on a dependent variable and at least one independent variable which he or she believes affects the dependent variable. To fix ideas with an example, a dependent variable might be an hourly wage and an independent variable might be years of education. The dataset will contain observations for the hourly wage and years of education of at least 40 individuals. The regression will then estimate how an individual's hourly wage varies with his or her years of education. In other words, the economist will use regression analysis to estimate an individual's expected hourly wage (or some other dependent variable) conditional on the individual's years of education (or some other independent variable). Like all other methods of empirical economic investigation, regression analysis cannot determine that the independent variable (years of education, in this example) causally affects the dependent variable (hourly wage, in this example). At heart, regressions are a statistical methodology and there is no such thing as statistical causation. Hence, the economist must assume, based on literature or intuition, that a causal relationship between the independent and dependent variable exists before using a regression.<sup>145</sup>

Had Cebr chosen to employ regression analysis in place of the chosen model, we would have used regressions to estimate the values of the aforementioned headline macroeconomic indicators of interest (treating them as dependent variables), conditional on the prevalence of QM in the UK economy (treating this as an independent variable). In order to produce accurate estimates, regression analysis requires a significant degree of variation in the dependent and independent variables, and a comprehensive and accurate observation of those variations. The overall prevalence of QM in the UK economy does not change dramatically from

one year to the next, and annual changes in the prevalence of QM in the UK economy are not captured comprehensively by the available data. Hence, the (above) precondition of regression analysis being able to produce comprehensive and accurate estimates was not satisfied. The implication is that a regression analysis would have produced uncertain estimates of QM's impact on the headline macroeconomic variables of interest.<sup>146</sup> As such, Cebr chose not to employ regression analysis when estimating how QM impacts the headline UK macroeconomic indicators of interest. Given the available data, the use of regression analysis would have been completely inappropriate.<sup>147</sup>

The second reason that the chosen modelling methodology was employed is that it has a solid grounding in economic theory. (Regression analysis, being, at core, a purely statistical method of analysis, requires no such grounding.) The model produces estimates of the impacts of QM by breaking the economy down into eight sectors. It then estimates the effect QM has on the productive technology of each sector under both counterfactual scenarios.<sup>148</sup> Via these estimated impacts on sectoral production technology, QM's effects on each sector's contribution to UK GDP, employment and net Exchequer tax receipts are estimated. Aggregating across the sectors yields the headline UK economy-wide estimates. The underlying theory, Cobb-Douglas production functions, is well established in the economic literature.<sup>149</sup> At the sector level, Cobb-Douglas production functions account for how changes to productive technology affect outputs.<sup>150</sup>

Later, subsections 5.3, 5.5 and 5.6 estimate QM's contribution to GDP, net Exchequer tax receipts and employment respectively. At the beginning of each of these respective subsections, there is a discussion explaining the mechanism by which QM is believed to impact GDP, net Exchequer tax receipts and employment respectively.

## 5.2 The modelling method, assumptions and limitations

This subsection provides a detailed explanation of how Cebr's model was constructed using inputs provided by the evidence base produced as part of our study, namely the survey, literature review and in-depth case studies. We also describe how the model formulates its estimates as to the impacts of QM on UK GDP, employment, and some of the benefits to the Exchequer. How the model estimates QM's impact on sectoral production technology is also explained. The model's assumptions and limitations are discussed throughout.

Cebr's bespoke economic model divides the economy into eight sectors for each year of the study period; 2009-13. The sectors are: (i) manufacturing; (ii) financial, business, scientific and real estate services; (iii) transport; (iv) public administration; (v) health and social work; (vi) education; (vii) retail and wholesale; and (viii) other. The first seven sectors comprise over 80% of UK annual GDP.

In each sector, and in each year, there is level of efficiency implicit in that sector's production technology. The degree of efficiency of a sector's production technology reflects the ease with which it can convert inputs, labour and capital into goods and services. A sector with a low degree of efficiency in its sectoral production technology might only be able to produce one unit of good or service using one unit of capital and one unit of labour. This would imply that inputs cannot be converted into goods and services particularly easily in that sector. Another sector with a higher degree of efficiency in its sectoral production

technology might produce five units of goods or services using the same inputs. This would imply that inputs can be converted into goods and services with greater ease in the second sector. Hence, the higher the degree of efficiency in a sector's production technology the lower the costs it faces per unit of good or service it produces.

The model assumes that the degree of efficiency of a sector's production technology is dependent on the intensity of QM implementation in that sector. The greater the intensity of QM implementation in any given sector, the higher the degree of efficiency of its production technology.

The model is predicated on the following causal assumption: "The greater the intensity of QM implementation in any given sector, the higher the degree of efficiency of its production technology.<sup>151</sup> Following on from that, the higher the degree of efficiency of a sector's production technology, the greater its contributions to economy-wide GDP, employment and Exchequer net tax receipts." Taking this assumption as a given is a precondition of enabling the model to estimate the impacts of QM on UK economy-wide (i) GDP; (ii) employment; and (iii) net benefit to the Exchequer. The truth of this assumption is supported by three independent sources: the literature review, the survey of 120 organisations and 18 in-depth case study interviews. Because these sources were independent, this coherency provides a strong indication that causal assumption is correct. It is extremely unlikely that three independent primary data sources would all be incorrect in the same way. Hence, Cebr has confidence in the model's underlying causal assumption.

At the core of Cebr's model is a mathematical description of the economy. However, there is no mathematical definition of causation. As such, assumptions about causation must be built into the model. This requirement is a feature of all mathematical models of the economy; it is not peculiar to the model developed by Cebr for the purpose of this study. The reliance on the above causal assumption constitutes a necessary limitation of the model, but one which is common across all economic models. Because three independent data sources all support the existence of the (above) chain of causation, Cebr believes the above causal assumption is correct.<sup>152</sup> The purpose of Cebr's bespoke economic model is to estimate the magnitude of the impacts of QM on UK economy-wide (i) GDP, (ii) employment and (iii) net benefit to the Exchequer, assuming that this key causal assumption is correct. All empirical methods of economic estimation, both modelling and regression analysis, require the use of a causal assumption because there is no such thing as mathematical or statistical causation. The existence of a causal relationship is not something which any model or regression could possibly analyse. This limitation – the requirement that a causal relationship is assumed – is not peculiar to Cebr's economic model; it is a limitation of all empirical economic models and regression analyses.

For each sector in each year of the study period the intensity of the sector's QM implementation is estimated on a 0-1 scale. A score of 0 implies that the sector has not implemented any QM at all, Counterfactual One. A score of 1 implies that the sector has implemented QM as fully as possible, Counterfactual Two. The estimates attained are reflective of the actual intensity of each sector's QM implementation which exists in reality under the Baseline Scenario.

Under the Baseline scenario, for each year of the study period each sector's intensity of QM implementation is estimated. These estimates are designed to reflect any given sector's intensity of QM implementation as it actually is in economic reality. In all cases, the estimates of each sector's intensity of QM implementation are strictly between 0 and 1 because, as is apparent from the literature, case studies and in-depth interviews, all sectors have implemented QM to some extent but none have implemented it fully. A sector which has implemented QM relatively intensively thus achieves a Baseline Scenario QM implementation intensity score estimate which is higher than that achieved by some other sector which has implemented QM relatively unintensively. While the use of these QM implementation score estimates constitutes a limitation of the model, the significant amounts of data generated from the literature review, case studies and survey imply a high degree of confidence that each sector's estimated intensity of QM implementation accords closely with reality. It is necessary to use estimates because, once again, each sector's intensity of QM implementation cannot be directly observed. The estimation of QM implementation scores for the different sectors under the Baseline Scenario is now explained.

The QM implementation scores for (i) manufacturing, (ii) financial, business, scientific and real estate services, (iii) transport, and (iv) public administration were inferred using data from in-depth interviews and the literature. During the in-depth interviews, several respondents discussed how far their organisation's QM implementation programmes have progressed, relative to their final, long-term QM implementation goals. Taking an average response for sectors (i) to (iv), enabled Cebr to estimate the intensity with which QM had been implemented in each sector. These estimated degrees of QM intensity hold in the Baseline Scenario. In some cases, the literature also discussed how far QM had been implemented in these four sectors and so was used to inform the respondents' discussions. This added further robustness to Cebr's estimates of the intensity of QM implementation for each sector in the Baseline Scenario.<sup>153</sup>

The health and social work sector intensity of QM implementation scores for the Baseline Scenario were inferred from public sector data given by a survey of 120 organisations. Three points are of note: (i) Survey respondents' provided estimates of how important QM is to public sector institutions' success; (ii) Healthcare and social work are provided overwhelmingly by the public sector; and (iii) The greater the importance attached to QM uptake, the greater the incentive for the public sector institution to implement QM programmes. This degree of incentivisation was assumed to correlate with the organisations' actual QM uptake.<sup>154</sup> Points (i), (ii) and (iii) imply that the greater the incentive for public sector organisations to implement QM, the more intensively healthcare and social work institutions will have implemented QM procedures under the Baseline Scenario.

The literature discussed how far QM programmes had been implemented across the UK education sector. This enabled Cebr to estimate the intensity of QM implementation in the UK education sector under the Baseline Scenario.<sup>155</sup>

The literature also allowed Cebr to estimate the intensity of QM implementation score for the retail and wholesale sector. Doms (2003) gave measures of IT and total investment across c.17,000 businesses in the sector.<sup>156</sup> Cebr assumed that a business's

intensity of QM implementation correlated with the proportion of its revenues which it invested. Hence, the average degree of investment for a typical business in the retail and wholesale sector, which Doms (2003) identified, enabled Cebr to estimate the sector's intensity of QM investment under the Baseline Scenario.

Together, these sectors: (i) manufacturing; (ii) financial, business, scientific and real estate services, transport; (iii) public administration; (iv) health; (v) social work; (vi) education; and (vii) retail and wholesale – comprise over 80% of the economy. The remaining sectors of the economy were aggregated into a single new sector. This new aggregated sector's QM intensity score under the Baseline Scenario was interpolated from available data on sectors (i) to (vii).

Overall, Cebr is confident that these estimates accurately reflect how far QM has been implemented in each of the sectors of the economy. We are confident that these estimates are an accurate reflection of sectoral QM intensity under the Baseline Scenario for four reasons:

- i. In cases where multiple independent sources were available to estimate the intensity of QM implementation scores for one sector, the sources cohered closely with each other. It is unlikely that these independent sources would all be incorrect in the same way.
- ii. No matter which primary data source was used, across all sectors the data inputs were coherent with each other in that they all indicated that each sector had implemented QM to some degree. The absence of any aberrative data inputs (which might have shown that some sector had not implemented any QM at all) increases our confidence in all the data inputs and hence in the estimates of the intensity of QM implementation scores.
- iii. When Cebr inferred the QM scores from available data, our inference methods agreed with established economic theory.
- iv. Cebr was able to attain direct estimates of QM implementation for c.80% of the economy. The use of such a large body of data, drawn from independent and mutually corroborative sources, means we have confidence in the intensity of QM implementation score for the remaining c. 20% of the economy.

The degree of efficiency of each sector's production technology is also derived for the Baseline scenario. These derivations reflect each sector's efficiency of production technology as it actually is in reality. Each sector's degree of production technology efficiency is derived as a function of that sector's labour inputs, capital inputs and gross value added in a Cobb-Douglas framework. Since each sector's labour inputs, capital inputs and gross value added are reported in ONS's official statistics each year, Cebr has a high degree of confidence in the derivations for each sector's production technology efficiency.<sup>157</sup>

Under the Baseline Scenario, each sector's contribution to employment, GDP and net contribution to the Exchequer is inferred from ONS statistics. The inference is a simple summing procedure and does not make the model's results any less credible.

Under Counterfactual One, for each year of the study period, each sector's intensity of QM implementation score is assumed to be zero. The rigorous definition of Counterfactual One, which is now given, reflects a hypothetical situation in which

no organisation in any sector has implemented any QM programmes at all.<sup>158</sup> As per this report's working definition of QM, Counterfactual One is defined as a situation in which no organisation in any sector of the economy would have: (i) quantified elements of productive processes to drive continual improvements in quality; (ii) implemented procedures systematically across the organisation to better meet customer requirements; nor (iii) instituted systems to facilitate the planning of product lifecycles and delivery. As a consequence of not implementing any QM, each sector's degree of production technology efficiency is lower under Counterfactual One than under the Baseline Scenario. Even under Counterfactual One, each sector's degree of production technology efficiency is still positive because several factors, besides QM, allow a sector to transform capital and labour inputs into goods and services. Ultimately, for any fixed amount of labour and capital inputs, each sector will produce fewer units of goods and services under Counterfactual One than under the Baseline Scenario. Resultantly, each sector's contribution to economy-wide GDP, employment and net contribution to the Exchequer is lower under Counterfactual One than under the Baseline Scenario.

Under Counterfactual Two, for each year of the study period, each sector's intensity of QM implementation is assumed to be one. The rigorous definition of Counterfactual Two, given below, captures a hypothetical scenario wherein all organisations in all sectors have implemented QM as fully as possible.<sup>160</sup> As per this report's definition of QM, Counterfactual Two is a situation where all organisations in the economy would have quantified all the elements of their productive processes rigorously and applied these quantitative insights to drive continual improvements in quality. Each organisation would have implemented a systematic group of procedures to gain information on customer requirements and meet those requirements. Finally, each would have procedures facilitating the rigorous, data-based planning of product lifecycles and delivery. In short, under Counterfactual Two, each organisation, in each sector, would be doing the maximum it possibly could to institute and act on effective QM procedures which were informed by real-world quantitative inputs. As a consequence of implementing QM programmes as intensively as possible, each sector's degree of production technology efficiency is higher under Counterfactual Two than under the Baseline Scenario. Resultantly, each sector's contribution to economy-wide GDP, employment and net contribution to the Exchequer is greater than under the Baseline Scenario.

The following paragraphs describe the mechanism whereby Cebr's bespoke economic model formulated estimates for the extent to which QM procedures, as they exist in reality, have increased economy-wide GDP and employment and how much they have contributed to the Exchequer for each year from 2009 to 2013.

For each sector and for each year of the 2009-13 study period, the literature, case studies and survey data have enabled Cebr to estimate how a hypothetical move from the level of QM intensity described in Counterfactual One, to the level of intensity which was estimated in the Baseline Scenario, would have increased the sector's production technology efficiency. For each sector, based on the literature, case studies and survey data, Cebr estimated how this change in the level of QM intensity would have increased that sector's contribution to the UK's economy-wide GDP, employment and net contribution to the Exchequer.

The hypothetical change in the level of QM intensity affects these variables via its impact on the efficiency of the sector's production technology.

For each sector, the model requires estimates of the impact of a hypothetical move from the level of QM intensity described in Counterfactual One to the level of intensity which was estimated in the Baseline Scenario on the efficiency of sectoral production technology. The model's results will deviate from reality to the extent that these input estimates deviate from reality, so the necessity of such an estimate constitutes a limitation of the model. However, the case studies, literature review and survey provided an appreciable body of data from which these input estimates were drawn. A careful examination of this data means that Cebr is confident that the input estimates reflect reality closely. As such, the necessary use of these input estimates is unlikely to invalidate model's estimates as to how QM impacts the headline economy-wide indicators of interest.

For each sector and for each year of the 2009-13 study period, there exist estimates as to how a hypothetical move from the level of QM intensity described in Counterfactual One to the level of intensity which was estimated in the Baseline Scenario would have increased the production technology efficiency. Consequently, for each sector and for each year of the 2009-13 study period, there are estimates as to how this hypothetical move has increased each sector's contribution to economy-wide GDP, employment and net contribution to the Exchequer.

In any one year, aggregating together the eight sector-specific estimates will yield an overall estimate as to how much this hypothetical move has contributed to economy-wide GDP, employment and net benefit to the Exchequer. These constitute the model's headline estimates of QM's impacts.

The following paragraphs detail the mechanism by which the model derived estimates for how far QM procedures, if (relative to the Baseline Scenario) they were rolled out as fully as possible in all sectors of the economy, would have increased economy-wide GDP and employment. The limitations which applied to the mechanism described above apply equally to this mechanism.

We again estimated how a hypothetical move from the level of QM intensity which was estimated under the Baseline Scenario to the level of intensity under Counterfactual Two would have increased the sector's production technology efficiency. This was used to estimate QM's GDP and employment impacts.

Replicating the above aggregation procedure enables Cebr's model to estimate the extent to which QM procedures, if (relative to the Baseline Scenario) they were rolled out as fully as possible across the UK economy, would have increased economy-wide GDP and employment, and how much they would have contributed to the Exchequer for each year from 2009 to 2013.

This subsection described how the model used the inputs provided by the literature review, survey and in-depth case studies to formulate its estimates for the impacts of QM on UK economy-wide (i) GDP, (ii) employment, and (iii) net benefit to the Exchequer. The model's assumptions and limitations were discussed throughout. The assumptions were found to be reasonable and the limitations were not found to be a cause for concern. In short, this sub-section described where the model's estimated findings come from.

The following subsections detail and discuss those estimated findings.

### 5.3 Estimated QM impacts on real annual GDP

This subsection details the model's estimates as to how QM contributes to UK annual GDP.<sup>161</sup> As discussed earlier, the intensity of QM implementation throughout the economy is believed to impact GDP. It is believed that increasing the intensity of QM implementation throughout the economy exerts (albeit indirectly) upward pressure on GDP.

The increases in GDP which attain due to QM are ultimately driven by QM's effect on the efficiency of productive technology. Increasing the intensity of QM implementation in a given sector enables that sector to add more value in terms of the goods and services it produces. It also enables the sector to contribute more in terms of net taxes on products. Because the sum of these metrics for all sectors is identical to economy-wide GDP, increasing the intensity of QM implementation throughout the economy is believed to increase GDP.

In 2011, the model estimated the value of annual UK GDP as being £1.347 trillion (in terms of real 2009 pounds) under Counterfactual One, where no organisation had implemented any QM at all. Under the Baseline Scenario – which reflected the 2011 economy as it actually was – annual UK GDP was £1.433 trillion. These estimates were calculated in the manner described in the preceding subsection.

As noted in the previous subsection, comparing annual GDP under the Baseline Scenario to estimated GDP under Counterfactual One provides an estimate of how much QM programmes, as they are actually constituted in the economy, have contributed to GDP. Hence, in 2011, the existence of QM mechanisms as they existed that year, were estimated to have contributed £86bn to the UK economy (in terms of real 2009 pounds). Otherwise put, if, in 2011, there had been no QM procedures anywhere in the UK economy at all, the model estimates that annual real GDP would have been 6.02% lower than it actually was that year.

As noted in the previous subsection, estimated annual real GDP under Counterfactual Two and actual real GDP under the Baseline Scenario can be compared. Such a comparison provides an estimate of how much more QM mechanisms could have contributed to GDP had they been rolled out as fully as possible across the economy.

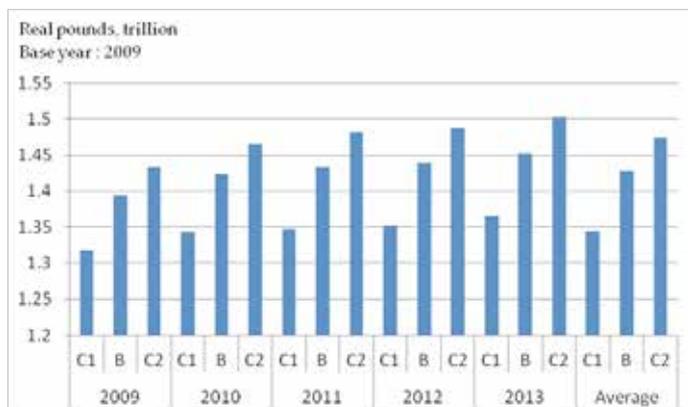
In 2011, estimated real GDP under Counterfactual Two was £1.481 trillion. Hence, a comparison of GDP under the Baseline Scenario and estimated GDP under Counterfactual Two provides the estimate that, had QM mechanisms been rolled out as fully as possible across all organisations in the economy, GDP would have been £48bn higher than it actually was. Otherwise put, if, in 2011 QM procedures had been implemented as fully as possible everywhere in the UK economy, it is estimated that annual real GDP would have been 3.37% higher than it actually was. This is the model's estimate of how much more QM mechanisms could have contributed to the economy in 2011 had they been implemented as fully as possible.

In order to contextualise the 2011 estimates, Figure 9 details the model's predictions of what UK real annual GDP would have been under each of the three different QM scenarios for each year of the 2009-13 study period.<sup>162</sup>

Figure 9 also provides an average estimate: this captures what real UK GDP is expected to have been under each of the three QM scenarios in a typical year. Under the Baseline Scenario, typical annual UK GDP was estimated to have been £1.428 trillion. The corresponding results for Counterfactuals One and Two are £1.345 trillion and £1.473 trillion respectively. Following on from the discussion in the preceding subsections, comparing real GDP under the Baseline Scenario to estimated real GDP under Counterfactual One provides a prediction of how much QM programmes contributed to the economy in a typical year of the study period. Hence, for the typical year of the study period, QM was estimated to have contributed £83bn to GDP (in real 2009 pounds). This implies that, for the typical year of the study period, 5.83% of annual GDP was due to QM in the economy. Note that this estimate pertains to an average year of the study period. The earlier estimate, that QM programmes had contributed 6.02% to real annual GDP, referred to the most recent completed year of the study period; 2011. This difference exists because QM programmes were estimated to have had a greater proportional impact on 2011 real annual GDP than on GDP for an average year of the 2009-2013 study period.<sup>163</sup>

Comparing estimated real GDP under Counterfactual Two to real GDP under the Baseline Scenario provides an estimate of how much more QM could have contributed to the economy in a typical year, had QM mechanisms been rolled out fully across the economy. This potential contribution was estimated at £46bn of GDP. These estimates imply that, for the typical year of the study period, annual GDP could have been 3.2% higher than it actually was, had QM been rolled out as fully as possible across the economy.

Figure 9: Real UK annual GDP under different QM scenarios



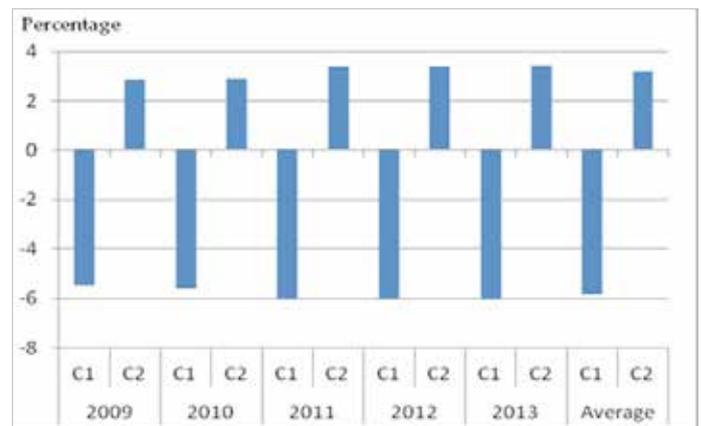
Notes: C1 denotes Counterfactual One. B denotes the baseline scenario. C2 denotes Counterfactual Two. Results are in terms of trillions of real 2009 pounds.

Note that in each year, and on average, the model's estimate of real GDP is lower under Counterfactual One than under the baseline scenario. This suggests that the implementation of QM has already exerted upward pressure on GDP. Similarly, in each year and on average the model's estimate of real GDP is higher under Counterfactual Two than under the baseline scenario. This suggests that further implementation of QM has the potential to exert additional upward pressure on UK GDP.

For 2011 and for a 'typical year', there has already been some discussion of the estimated percentage differences in real annual UK GDP under the different QM scenarios. Figure 10 details the model's percentage estimates of how much lower annual

GDP would have been under Counterfactual One than under the Baseline Scenario for each year of the study period and for a typical year. These data summarise the model's estimates of how far QM mechanisms, as they exist in reality, have increased real annual UK GDP in percentage terms. Figure 10 also gives the model's percentage estimates of how much higher annual GDP would have been under Counterfactual Two than under the Baseline Scenario. These data are estimates as to how much further QM mechanism, if they had been fully rolled out across the UK economy, could have raised real annual UK GDP in percentage terms.

Figure 10: Percentage GDP effects of moving between the baseline QM scenario and the two counterfactual scenarios



Notes: C1 denotes how much lower real GDP would be under Counterfactual One than under the baseline scenario in percentage terms. C2 denotes how much higher real GDP would be under Counterfactual Two than under the baseline scenario in percentage terms.

Figure 10 gives similar results to Figure 9. In each year, and on average, the model estimates that, in percentage terms, GDP is lower under Counterfactual One than under the baseline scenario. This suggests that the implementation of QM programmes, as they are actually constituted in the economy, have exerted upward pressure on GDP. The model estimates that real GDP is higher under Counterfactual Two than under the Baseline Scenario. This suggests that further implementation of QM has the potential to exert additional upward pressure on UK GDP.

In percentage terms, the estimates provided by Figure 10 indicate that the GDP differentials between Counterfactual One and the Baseline Scenario were larger than those between Counterfactual Two and the Baseline Scenario. This implies that, although QM has the potential to contribute significantly to real annual GDP if it were rolled out further, the majority of the GDP gains which arise from QM implementation have already been achieved.

#### 5.4 Estimated QM impacts on sectoral production technology

Following previous discussions, the intensity of QM implementation in a given sector impacts the efficiency of that sector's production technology. The efficiency of a sector's production technology captures the ease with which it can transform capital and labour inputs into goods and services. It is believed that the higher the intensity of QM implementation in a given sector, the higher the efficiency of that sector's production technology. Thus, raising sectoral QM intensity increases the

number of units of goods and services which the sector can produce using a fixed amount of labour and capital inputs. As was discussed in previous subsections, the intensity of QM implementation on sectoral production technology is what enables QM to impact on GDP, employment and net benefit to the Exchequer.

The intensity of QM implementation in a given sector varies as the economy moves between the three QM scenarios.<sup>164</sup> For each sector and in each year, the Baseline Scenario captures the intensity of QM implementation as it actually is. Hence, this scenario also captures the efficiency of sectoral production technology as it actually is. Counterfactual One describes an economy in which no organisation in any sector has implemented any QM at all. As such, under Counterfactual One, the efficiency of each sector's production technology is less than under the Baseline Scenario. Counterfactual Two describes an economy in which all organisations in all sectors have implemented QM as fully as possible. Under Counterfactual Two, the efficiency of each sector's production technology is greater than under the Baseline Scenario.

Figures 11a through 11f detail the model's percentage estimates of how much lower different sectors' levels of productive technology efficiency would have been under Counterfactual One than under the Baseline Scenario.<sup>165</sup> The model's percentage estimates of how much higher the different sectors' levels of productive technology efficiency would have been under Counterfactual Two than under the Baseline Scenario, are also given for each year of the study period.<sup>166</sup> The findings given are not exhaustive, but cover the manufacturing, services, education and public administration sectors. Figure 11f details the percentage estimates for a typical year. These reported findings typify all the model's estimates as to the impact of QM on different sectors' levels of productive technology efficiency.

It has already been explained how the different intensities of sectoral QM implementation, which pertain under the three different QM scenarios, are estimated to impact sectoral levels of productive technology efficiency. The projected percentage effects on sectors' productive technology efficiency, of moving between the Baseline Scenario and the two Counterfactual scenarios (in Figures 11a to 11f below) are derived from these estimated impacts.

Based on literature, case study interviews and survey evidence, the model assumes that QM programmes, as they are instituted in reality, exert a relatively large upward effect on the productive technology efficiency of the manufacturing and services sectors under the Baseline Scenario. This is because, based on the literature review, survey and case study evidence, the model assumes that QM programmes have been implemented with a comparatively high degree of intensity in those sectors under the Baseline Scenario.

Based on the same body of evidence, the model assumes that QM programmes, as they are instituted in reality, exert a comparatively modest upward effect on the productive technology efficiency of the education and public administration sectors under the Baseline Scenario. This is because the model assumes that QM programmes have been implemented with a relatively slight degree of intensity in those sectors under the Baseline Scenario.

Consequently, in percentage terms, the model yields the prediction that a hypothetical move to Counterfactual One from the Baseline Scenario tends to decrease the manufacturing and services sectors' levels of productive technology efficiency noticeably more than those of the education and public administration sectors.

In percentage terms, the model's estimates also indicate that a hypothetical move to Counterfactual Two from the Baseline Scenario tends to increase the education and public administration sectors' levels of productive technology efficiency noticeably more than those of the manufacturing and services sectors.

### 5.5 Estimated QM impacts on the Exchequer's net tax receipts<sup>167</sup>

Based on the inputs drawn from the literature review, survey and case studies, and the (previously discussed) assumptions about causality, the model predicts that that QM impacts the Exchequer's real annual net tax receipts from taxes imposed on production and products. As the intensity of QM implementation in the economy increases, the levels of sectoral production technology efficiency increase for all sectors. This causes each sector to produce more goods and services. Because these are taxed, this increases the Exchequer's real annual net tax receipts from taxes imposed on production and products. This is termed the "net benefit to the Exchequer."

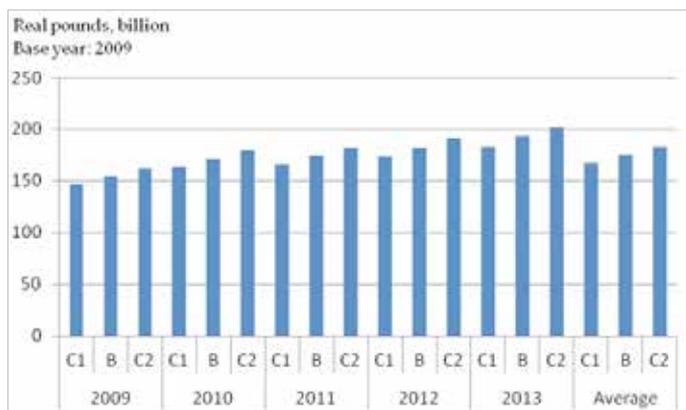
Returning again the most recent completed year; in 2011, these net tax receipts were £174.8bn under the baseline scenario.<sup>168</sup> Because the intensity of QM implementation is lower under Counterfactual One than under the Baseline Scenario, it is estimated that net tax takings would have been only £166.4bn in 2011 under Counterfactual One. This estimate follows directly from the 2011 real annual GDP estimate under Counterfactual One. Moving from the Baseline Scenario to Counterfactual One induces a real GDP decline as we move to an economy in which QM systems do not exist. This means that businesses produce fewer and/or less valuable products. As a consequence, there are fewer products to tax and those which remain are less valuable, meaning each yields less tax revenue when it is taxed. Consequently, net tax takings decline. A comparison of the Exchequer's tax receipts under Counterfactual One and the Baseline Scenario provides an estimate of how much QM procedures, as they were actually instituted in the economy, contributed to the Exchequer. In 2011, the model predicts that QM procedures provided a net benefit of £8.4bn to the Exchequer. The model's results suggest that net tax receipts would have been 4.8% lower than they actually were in 2011, had Counterfactual One attained.

In that same year, the model estimates that, had QM mechanisms been instituted as fully as possible throughout the economy, the Exchequer's net tax receipts from taxes on production and products would have been £182.8bn. This is the situation which would hold under Counterfactual Two. Comparing tax receipts under the Baseline Scenario and Counterfactual Two provides the estimate that, if QM systems were instituted as widely as possible throughout the economy, the Exchequer's net tax takings would have been £8bn higher than they actually were. Hence, the model estimated that net tax receipts would have been 4.6% higher than they actually were in 2011, had Counterfactual Two attained.

Figure 12 details estimates of what the Exchequer's real net tax receipts from taxes on production and products would have been under each of the three different QM scenarios in the different years of the study period. This provides context to the headline 2011 estimates, as discussed above. To contextualise the 2011 estimates further, estimates of the Exchequer's real annual net tax takings from taxes imposed on production and products under each of the three scenarios for a typical year are also given.

The estimates for a typical year suggest that under the Baseline Scenario the Exchequer's net tax receipts were £175.3bn. The corresponding estimates for Counterfactuals One and Two are £166.9bn and £183.4bn respectively. These estimates imply that, in a typical year, QM mechanisms, as they actually exist in the economy, contributed £8.4bn to the Exchequer. Otherwise put, the model's results suggest that net tax receipts would have been 4.8% lower than they actually were in the typical year, had Counterfactual One attained. Similarly, for a typical year, QM mechanisms, had they been rolled out as fully as possible in all sectors of the economy, could be expected to have contributed an additional £8.1bn to the Exchequer's coffers. Hence, the model estimated that net tax receipts would have been 4.6% higher than they actually were in the typical year, had Counterfactual Two attained.

Figure 12: Real annual net tax receipts from taxes on production and products under different QM scenarios

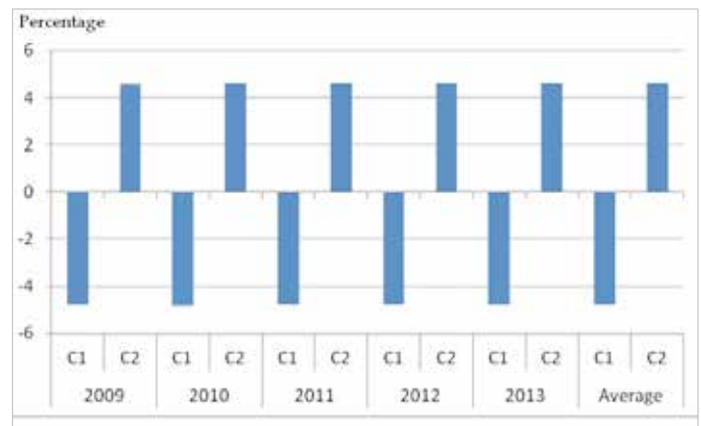


Notes: C1 denotes Counterfactual One. B denotes the baseline scenario. C2 denotes Counterfactual Two. Results are in terms of trillions of real 2009 pounds.

In each year, and on average, the model's estimate of real net tax takings is less under Counterfactual One than under the Baseline Scenario. This suggests that QM has already contributed to the Exchequer's net tax receipts arising from taxes on production and products. In each year and on average the estimate of net tax takings is greater under Counterfactual Two than under the baseline scenario, implying that further implementation of QM could exert additional upward pressure on net tax receipts.

Figure 13 details the model's percentage estimates of how much lower the Exchequer's annual net taxes on products and production would have been if Counterfactual One had attained, rather than the Baseline Scenario. Percentage estimates of how much greater annual net tax takings would have been under Counterfactual Two than under the Baseline Scenario are also given. (These percentage estimates have already been discussed for 2011 and the typical year.)

Figure 13: Percentage changes to annual net tax receipts from taxes on products and production resulting from moves between the baseline QM scenario and the two counterfactual scenarios



Notes: C1 denotes how much lower real net tax takings would be under Counterfactual One than under the baseline scenario in percentage terms. C2 denotes how much higher real net tax receipts would be under Counterfactual Two than under the baseline scenario in percentage terms.

Figure 13 demonstrates that, in each year and on average, the model estimates that, in percentage terms, the Exchequer's net tax receipts are lower under Counterfactual One than under the Baseline Scenario. This suggests that the implementation of QM programmes, as they are actually constituted in the economy, have exerted upward pressure on the Exchequer's net tax receipts. The model estimates that real net tax receipts are higher under Counterfactual Two than under the Baseline Scenario. This suggests that further implementation of QM has the potential to exert additional upward pressure on real net tax receipts.

In percentage terms, the estimates provided by Figure 13 indicate that the real net tax receipt differentials between Counterfactual One and the Baseline Scenario are approximately equal to those between Counterfactual Two and the Baseline Scenario. This implies that the potential which QM has to further increase real net tax takings (if it were rolled out as fully as possible) is approximately equal to those net tax gains which have already come about as a result of QM's actual implementation.

### 5.6 Estimated QM impacts on employment

Because increasing the intensity of a sector's QM implementation goes on to increase its level of productive technology efficiency, it makes labour more productive. Labour becomes more productive in the sense that, as the level of productive technology efficiency increases, each unit of labour can produce a greater amount of goods and services. This means that, all other things being equal, a sector can expect to face lower labour costs per unit produced, the more intensively it has implemented QM.<sup>169</sup>

Increased labour efficiency incentivises organisations to increase employment at the sector level. Because increasing the intensity of QM implementation increases labour efficiency across all sectors, it ultimately drives increases in economy-wide employment.

The model's estimates reveal two observations:

- i. QM has already made a substantial contribution to economy wide employment.
- ii. If QM were rolled out more fully than under the baseline scenario, it could exert additional upward pressure on employment.

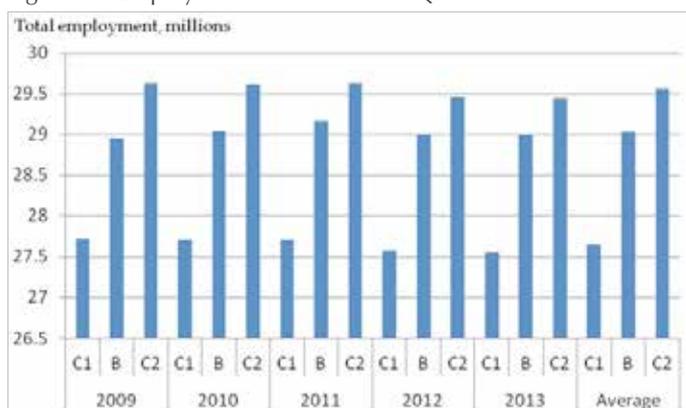
In the most recent completed year, 2011, employment was 29.16 million under the Baseline Scenario. Under Counterfactual One, because labour is less productive, the model estimates that employment would have stood at only 27.71 million. Comparing employment under both these scenarios produces the estimate that QM programmes, as they were actually instituted in 2011, caused employment to be 1.43 million higher than it would otherwise have been. Otherwise put, in 2011, the model's results suggest that employment would have been 4.94% lower than it actually was in 2011, if Counterfactual One had held.

Also in 2011, the model estimates that employment would have stood at a robust 29.62 million under Counterfactual Two. A comparison of employment under the Baseline Scenario to that which was estimated under Counterfactual Two provides the estimate that, had QM systems been rolled out as fully as possible in 2011, employment would have been 455,000 higher than it actually was. This suggests that employment would have been 1.57% higher than it actually was, had the economy been described by Counterfactual Two as opposed to the Baseline Scenario in 2011.

Figure 14 details the model results. It provides the estimates of employment under the Baseline Scenario and Counterfactuals One and Two for all years of the study period to contextualise the 2011 estimates which were discussed above. Furthermore, estimates of employment under the three scenarios for a typical year are also given. Under the Baseline Scenario, typical employment was estimated to have been 29.03 million. The corresponding results for Counterfactuals One and Two are 27.65 million and 29.56 million respectively.

These estimates imply that, in a typical year, QM procedures, as they actually exist, have made employment 1.38 million higher than it would otherwise have been. In other words, it is estimated that employment, in a typical year, would have been 4.75% lower than it actually was had QM programmes not been in existence at all throughout the UK economy. The estimates also imply that, in a typical year, QM procedures, if they were implemented as fully as possible, would have increased employment by a further 526,000, or 1.81%.

Figure 14: Employment under different QM scenarios

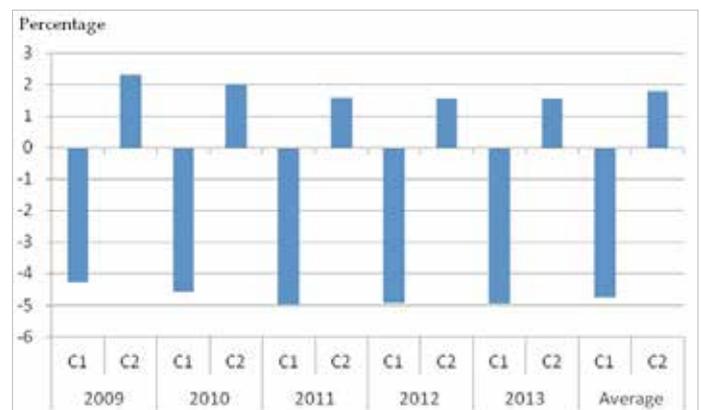


Notes: C1 denotes Counterfactual One. B denotes the baseline scenario. C2 denotes Counterfactual Two. Results are in terms of trillions of real 2009 pounds.

The model estimates that total employment is less under Counterfactual One than under the baseline scenario and less under the baseline scenario than under Counterfactual Two. These results indicate that QM has already contributed to total employment and that further roll-out of QM could push up employment more. An increased intensity of QM implementation pushes up economy-wide employment because it makes labour more productive.

Figure 15 denotes the model's percentage estimates of how much lower employment would have been if Counterfactual One had attained rather than the Baseline Scenario. Percentage estimates of how much higher employment would have been under Counterfactual Two than under the baselines scenario are also given. These estimates have already been discussed for 2011 and for a typical year.

Figure 15: Percentage employment effects of moving between the baseline QM scenario and the two counterfactual scenarios



Notes: C1 denotes how much lower employment would be under Counterfactual One than under the baseline scenario in percentage terms. C2 denotes how much higher employment would be under Counterfactual Two than under the baseline scenario in percentage terms.

In percentage terms, the estimates provided by Figure 15 indicate that the employment differentials between Counterfactual One and the Baseline Scenario were larger than those between Counterfactual Two and the Baseline Scenario. This implies that, although QM has the potential to contribute significantly to employment if it were rolled out further, the majority of the employment gains which arise from QM implementation have already been achieved.

### 5.7 Model conclusion

From their initial implementation in the armaments industry during WWI, QM procedures have diversified and grown more advanced. They now play a pivotal role in all sectors of the UK economy. Using evidence provided by the survey, literature review and in-depth case study interviews as inputs, Cebr's bespoke economic model has estimated the quantitative impacts that QM has had on the UK's (i) real GDP, (ii) employment, (iii) efficiency of sectoral production technology; and (iv) the Exchequer's net tax receipts.<sup>170</sup> This furthered the report's second aim of estimating the quantitative impact of QM procedures on UK headline economic variables.

The primary year of the analysis was 2011. This was chosen because it is the most recent completed year, so analysing it gave the most up-to-date estimates of QM's impacts. To ground the 2011 estimates in the recent past and near future, figures detailing the model's estimates for each year of the 2009-13 study period were also given. To provide additional context, estimates for a typical year of the study period were also provided.

The model derived two types of estimates:

- i. Estimates of the impacts which QM mechanisms, as they are currently instituted throughout the UK economy, have had headline indicators. These estimates come from comparing the findings of the Baseline Scenario with those of Counterfactual One.
- ii. Estimates of the impacts which QM mechanisms, if they were rolled out as fully as possible across the economy, could have in terms of further increasing these headline indicators. These estimates come from comparing the findings of the Baseline Scenario with those of Counterfactual Two.

Before the model's estimates were presented, subsections 5.1 and 5.2 detailed how inputs from the survey, literature review and in-depth case study interviews were used to derive the model's estimates. They also explained why the use of an economic model is the most appropriate methodology for accurately estimating QM's impacts on headline UK economic indicators.

In formulating the two (above) types of estimates, the model was subject to two principal limitations:

The first was that its estimates were only as good as its inputs, which were drawn from the literature review, case studies and survey and publically-available ONS data. These sources yielded a large quantity of high-quality input data which were thoroughly examined by Cebr. Additionally, the three data sources were independent but provided inputs which were coherent with each other. Because there is only one way for a data source to be exactly correct about the effects of QM, but (near) infinite ways for it to be incorrect, the independence and coherence of the data sources suggests that it is extremely unlikely that they yielded data which are incorrect. As such, Cebr believes that the model's inputs are close estimates of economic reality. Hence, the model's estimates are likely to be good matches with QM's real impacts.<sup>171</sup>

Secondly, the model relies on the causal assumption that the greater the intensity of QM implementation in any given sector, the higher the degree of efficiency of its production technology. Furthermore, the model assumes that the higher the degree of efficiency of a sector's production technology, the greater its contributions to economy-wide GDP, employment and Exchequer net tax receipts. Cebr's model is a mathematical description of the economy. However, there is no mathematical definition of causation. As such, assumptions about causation must be built into the model. The reliance on the above causal assumption is not a serious limitation because the literature, survey responses and in-depth interviews all support the existence of this chain of causation. (For instance, Kaynak (2003) and Deming (1982) both support this chain of causation.

The model's principal estimated findings pertain to QM's impacts on headline UK economy-wide indicators: GDP; employment; and the Exchequer's net tax receipts. They were as follows:

QM programmes, as they are currently instituted in the economy, are already estimated to have pushed up GDP significantly. In 2011, it was estimated that QM procedures contributed £86 bn to GDP (in terms of real 2009 pounds). Alternatively, GDP would have been 6.02% lower than it actually was in 2011, had no QM procedures been in existence. The model estimated that, if QM programmes had been rolled out as fully as possible throughout the economy, in 2011 GDP might have been £46bn (in terms of real 2009 pounds) or 3.20% higher. These findings indicated that, while the further roll out of QM programmes could benefit the economy substantially, the majority of the GDP gains which could arise from QM implementation have already been achieved. These estimates were representative of the other years of the study period and of the findings for a typical year of the study period.

The model estimated that QM programmes, as they are currently instituted, have already contributed markedly to the Exchequer's net tax receipts. In 2011, QM procedures were estimated to have contributed £8.4bn (in terms of real 2009 pounds) to the Exchequer. This estimate implies that net tax receipts (from taxes on products and production) would have been 4.8% lower than they actually were in 2011 had no QM programmes been in place in the UK. The model also formulated the estimate that, if QM programmes had been rolled out as fully as possible, in 2011 the Exchequer's net tax takings might have been £8bn (in terms of real 2009 pounds), or 4.6% higher than they actually were. These modelling findings suggest that the potential which QM has to further increase the Exchequer's net tax takings is approximately equal to the gains which have already come about as a result of QM's actual implementation. Again, these estimates were representative of the other years of the study period and of the findings for a typical year of the study period.

The estimates which Cebr's bespoke economic model formulated indicate that QM programmes, as they are actually employed throughout the different sectors of the UK economy, have been a substantial driver of employment. In 2011, it was estimated that QM procedures had caused UK economy-wide employment to be 1.43 million higher than it would otherwise have been, ie the model estimated that, in 2011, employment would have been 4.94% lower than it actually was had QM systems not been in existence at all in any sector of the UK economy. The model also attained the estimated finding that, if QM programmes had been instituted as possible in all sectors of the economy, in 2011 employment would have been 455,000, or 1.57% higher than it actually was. These estimates suggest that further implementation of QM programmes throughout the UK economy could increase employment significantly, however, the majority of the employment gains which could arise from the roll out of QM programmes have already been achieved. Again, these estimates were representative of the other years of the study period and of the findings for a typical year of the study period.

As explained before, the model estimated QM's impacts on the three above economy-wide indicators by first estimating its impacts on the levels of the efficiency of production technology for different sectors. These first estimated impacts then fed through to the three economy-wide indicators. The model's estimates suggest that, for all sectors and for all years of the study period, if there had been no QM in place, the efficiency of each sector's production technology would have been lower than it actually was in the real economy. Under the model's assumed causal framework, this implies that the values of economy-wide

GDP, employment and Exchequer net tax takings would have been lower than they actually were. The estimated findings also indicate that, if QM had been implemented as fully as possible throughout the entirety of all sectors in the economy, the efficiency of each sector's production technology would have been higher than it was in reality. Under the model's assumed causal framework, this implies that the values of economy-wide GDP, employment and Exchequer net tax takings would have also been higher than they were in reality.

Ultimately, based on solid inputs drawn from the case studies, literature review and survey, and resting on justifiable assumptions, the model produced estimates suggesting that QM procedures have improved headline UK economic indicators. The model's estimates also suggest that further increasing the roll-out of QM mechanisms would push up these indicators even further.

#### References

142. For the model and the entirety of the report, the net Exchequer tax receipts (or net benefit to the Exchequer) arising from QM implementation is defined as the sum of taxes less subsidies on products and production, from all sectors, resulting from that implementation. The analysis excludes taxes on incomes.
143. The model aims to estimate QM's effects on macroeconomic variables. As such, it does not estimate the Rol of QM programmes for individual businesses. Estimates of the Rol of individual businesses' QM programmes were derived in section 4. That section used case study evidence to estimate how an individual organisation's QM programme had affected its outcomes.
144. Because the model is built on these inputs, it coheres with the literature review, survey and case studies by construction. As such, the model's estimates are not compared to the findings of the literature review, survey and case studies.
145. Greene (2003), *Econometric analysis*, 5th edition. See Chapters 2-8 for an introductory discussion of regression analysis.
146. Wooldridge (2002), *Introductory Econometrics: A Modern Approach*. 2nd Edition. See Chapters 1-6.
147. Cebr economists had initially considered using a regression to estimate how QM impacts headline UK macroeconomic indicators. We soon realised that there would have been no benefit in even attempting to estimate these quantitative impacts using a regression. Hence, regressions were not employed at any stage of the investigation.
148. The productive technology of an organisation is the means by which it converts economic inputs (such as capital and labour) into outputs (such as goods and services). Productive technology is improved (or made more efficient) as production processes are changed, in a manner such that more outputs can be produced using the same quantity of inputs.
149. Douglas, (1976), 'The Cobb-Douglas Production Function Once Again: Its History, Its Testing, and Some New Empirical Values', *Journal of Political Economy* 84 (5)
150. The Cobb-Douglas production function for any sector is:  $y$  = goods or services produced (which can be measured as gross value added by proxy);  $K$  = capital inputs;  $L$  = labour inputs; and  $A$  = the sectoral production technology efficiency parameter.
151. where  $\phi$  is a functional relationship. The sectoral production technology efficiency parameter,  $A$ , has the following properties:
152. Arguments presented by Deming (1982) and Kaynak (2003) support this assumption in the literature.
153. See: Cua, McKone and Schroeder (2001), 'Relationships between implementation of TQM, JIT, and TPM and manufacturing performance', *Journal of Operations Management*, 19, pp. 675–694 and Yusof and Aspinwall (2001), 'Case studies on the implementation of TQM in the UK automotive SMEs', *International Journal of Quality Relations Management*, 18(7)
154. This assumption agrees with standard economic theory. All other things being equal, the greater the incentive an organisation has to implement a given procedure (QM or otherwise), the more intensively it will implement that procedure. See Varian (1999), *Intermediate Microeconomics: A modern approach*, Fifth edition, Chapters 26, 27 and 30.
155. See Osseo-Asare, Longbottom, and Chourides, (2007), 'Managerial leadership for total quality improvement in UK higher education', *The TQM Magazine*, 19(6), pp.541-560
156. Doms, Jarmin and Klimek (2003), 'IT Investment and Firm Performance in US Retail Trade', FRBSF Working Paper 2003-19
157. The functional form of the derivation is as follows:  $y = AK^{\alpha}L^{1-\alpha}$ , where  $A$  = sectoral production technology efficiency parameter;  $y$  = goods or services produced (which can be measured as gross value added by proxy);  $K$  = capital inputs and  $L$  = labour inputs.  $\alpha$ ,  $K$  and  $L$  all come from official ONS statistics, meaning Cebr has a high degree of confidence in the derivation of  $A$ . The formula is simply the Cobb-Douglas production function,  $y = AK^{\alpha}L^{1-\alpha}$ , re-arranged.
158. An intuitive definition of Counterfactual One was given near the start of subsection 5.1.
159. Principally, these several factors are: (i) the education, drive and workplace skills of labour; (ii) the sophistication of capital inputs; and (iii) the relationships between labour and capital in any given business or non-private sector organisation.
160. An intuitive definition of Counterfactual Two was given near the start of subsection 5.1.
161. All figures in this subsection are given in terms of real 2009 pounds. 2009 is the initial year of the model.
162. All figures are in real 2009 pounds. 2009 is the base year of the model.
163. Cebr's economic model estimated how moving between the Baseline Scenario and Counterfactual One affected real annual GDP in percentage terms. These estimates are different in each year because (i) the impact of the move between scenarios on real annual GDP in any given year is partially dependent on the rate of economic growth in that year, and (ii) the rate of economic growth differs in each year. In years where the rate of economic growth is comparatively high, the model was constructed such that moving to a scenario in which no QM exists anywhere in the economy has a greater impact on annual GDP than in years where growth is comparatively low. The model was constructed in this manner to reflect the most consistent finding of the literature review, case studies and survey: QM programmes were a key driver of organisations' growth. Hence, in high growth years, when QM systems (and other factors) are particularly important in driving rapid economic growth, moving to Counterfactual One depresses annual

- GDP by more than in low-growth years, when QM systems (and other factors) are comparatively unimportant in driving GDP growth.*
164. *See the discussion in subsection 5.2 for an explanation of how the intensity of QM implementation in each sector was estimated under the Baseline Scenario.*
165. *This percentage estimate is labelled C1 in Figures 11a through 11f.*
166. *This is labelled as C2 in Figures 11a through 11f.*
167. *To reiterate an important point, the net Exchequer tax receipts (or net benefit to the Exchequer) arising from QM implementation is defined as the sum of taxes less subsidies on products and production, from all sectors, resulting from that implementation.*
168. *Again, all figures are in real 2009 pounds. 2009 is the base year of the model.*
169. *This point is noted by Deming (1982) in Out of the Crisis.*
170. *Because the model is built on these inputs, it coheres with the literature review, survey and case studies by construction. As such, the model's estimates are not compared to the findings of the literature review, survey and case studies.*
171. *This limitation, that the quality of a model's results are reliant on the quality of its inputs, is a limitation of all economic models. This limitation is not peculiar to Cebr's model.*
172. *This requirement is a feature of all mathematical models of the economy; it is not peculiar to Cebr's model.*

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## 6 CONCLUSION

### 6.1 Aims and structural overview of the report

On behalf of the CQI, Cebr has compiled a report which investigated QM systems' impacts at the microeconomic level – of individual public, private and voluntary sector organisations – and at the macroeconomic level – of UK headline economy-wide indicators. Specifically, the report's dual research aims were to demonstrate and quantify the extent to which more effective, intensive and longer-term use of QM systems and techniques (i) creates more productive and successful organisations; and (ii) affects headline UK economic indicators.

The report made use of three investigative methods to gather primary evidence – a literature review, case studies and a survey of 120 organisations – in achieving the first aim. The literature review adopted a working definition of QM (which agrees with the CQI's definition) which applies to the report as a whole. As already described, the structure of investigation adopted by the case study and survey sections was a product of the literature review. The adopted structure of those sections allowed their findings to be easily compared to those of the literature review throughout the report. The findings of the literature review, case studies and survey were independent and usually found to be coherent with each other.<sup>173</sup> Precisely because they are independent, this coherency suggests that the data provided by the sources are correct. It is unlikely that three independent data sources would all be incorrect in the same way.

Thereafter, the report used the inputs provided by the literature review, case studies and survey to formulate a bespoke economic model which estimated the impacts of QM on headline UK macroeconomic indicators. Cebr reasoned that the construction of an economic model based on these inputs was likely to yield more accurate estimates of QM's impacts on the UK macroeconomy than the only feasible alternative; regression analysis. The wide range of inputs and Cebr's scrutiny of them suggested that the inputs used accorded closely with reality. This implication is that the findings of Cebr's bespoke economic model (which were ultimately derived from those inputs) also paralleled economic reality closely. Finally, three independent data inputs indicated that the causal assumption upon which the model was predicated – that QM can improve the efficiency of individual organisations' productive processes and that, in aggregate, this can improve headline UK economic indicators – was correct. Because the literature review, survey and case study data were all independent, it is extremely unlikely that the data they provided, as to the validity of the causal assumption, would have been incorrect in the same way. As such, their coherency means Cebr is confident that the model's underlying causal assumption was correct. As discussed in subsection 5.2, like all methods of empirical economic investigation (modelling or regression analysis) the

model had to rely on such a causal assumption.

This is because there is no such thing as mathematical or statistical causation. The model's purpose was to estimate the magnitude of QM's impacts on UK economy-wide macroeconomic indicators, assuming that the causal assumption is correct.

Having helped to establish causality, the literature review, case studies and survey were used to provide inputs into the model and give convincing arguments as to why its results can be trusted.<sup>174</sup>

### 6.2 Summary of the report's findings

In relation to the report's first aim, the literature review, survey and case studies consistently yielded evidence that the effective implementation of QM procedures and the attainment of QM certification could improve a variety of outcomes for organisations in the public, private and voluntary sectors.

The literature review found evidence that QM had increased stock prices, profits, revenues, customer retention and employee, customer and user satisfaction across institutions in the public, private and third sectors.<sup>175</sup> The literature review also found evidence that QM mechanisms reduce the costs associated with identifying and rectifying problems during or after production, while raising those expenditures which focus on stopping problems before they occur. This cost rebalancing was found to be associated with a reduction in overall costs. The literature review also suggested that QM programmes could have their most substantial impacts on organisations' outcomes several years after they were first instituted – ie they sometimes become effective with a lag. Finally, several of the authors under review noted that managerial commitment to a QM programme was a key precondition of its success in all sectors.

The survey of 120 organisations provided evidence which corroborated the literature's findings. Survey respondents indicated that QM mechanisms were important in driving down costs and maintaining customer or service-user retention rates. Private sector organisations reported that QM programmes were often used to help justify price premia on goods and services.

The case studies largely support the findings of the literature review for organisations in specific sectors. There were some notable points of departure between the literature review and case study findings for some sectors. For example, the case study respondents from the legal services sector note that their QM mechanisms became effective comparatively quickly – ie without the lag which was predicted by the literature. This suggests that QM mechanisms have their effects more rapidly in legal services businesses than in

those organisations which were examined by the authors of the papers and books of which the literature review was comprised.

Using inputs from the literature review, case studies and survey, Cebr's bespoke economic model achieved the report's second aim of estimating the impact of QM programmes on headline UK economic indicators. The principal estimates of the model were as follows:

- iv. In 2011, it was estimated that QM procedures contributed £86bn to UK GDP (in terms of real 2009 pounds). If QM programmes had been rolled out as fully as possible throughout the economy, in 2011 GDP might have been £46bn (in terms of real 2009 pounds) higher.
- v. In 2011, QM procedures were estimated to have contributed £8.4bn (in terms of real 2009 pounds) to the Exchequer. If QM programmes had been rolled out as fully as possible, in 2011 the Exchequer's net tax takings might have been £8bn (in terms of real 2009 pounds) higher than they actually were.
- vi. In 2011, it was estimated that QM procedures had caused UK economy-wide employment to be 1.43 million higher than it would otherwise have been. If QM programmes had been instituted as far as possible in all sectors of the economy, in 2011 employment could have been 455,000 higher than it actually was.

It is evident from the literature review, case studies and survey that QM's positive impacts on these headline UK macroeconomic indicators is a product of its effects on the performance of individual organisations. In aggregate, QM systems improve headline UK macroeconomic indicators precisely because they help organisations to produce more goods and services with the same inputs, while reducing cost, increasing employee and customer satisfaction, and raising revenues and profits.

Building on its discussion of individual organisations, and also furthering the report's second aim, the literature review's conclusions echo those of the model: QM programmes improve economy-wide macroeconomic outcomes. The literature review reached this conclusion with regard to QM programmes' impacts on the UK's GDP and international competitiveness.

The findings attained by Cebr's comprehensive examination of QM in the UK economy, and the methods used to achieve those findings, point to three broad conclusions:

- i. QM programmes have already played a vital role in the success of individual private, public and voluntary sector organisations and, in aggregate, have played a substantial role in improving UK macroeconomic outcomes.
- ii. If QM programmes were instituted more widely, these desirable effects would probably become more pronounced.
- iii. Cebr has placed a high degree of confidence in points i and ii because they were derived from independent and comprehensive sources which were in broad agreement with each other. Due to their independence, it is extremely unlikely that these sources would have yielded data which were coherent with each other if the data had not been reflective of reality. Because there is only one way to be absolutely correct, but (effectively) infinite ways to be incorrect, it is much more likely that they will have been independently reflective of

QM's effects as those effects are in reality.

The theme of these three conclusions, that QM systems substantially improve organisations' outcomes, can be encapsulated by examining the average estimated RoI effects of QM programmes. The RoI estimates, derived from the case study interviews, all indicated that businesses attain pecuniary benefits far outweighing the cost of implementing their QM systems. They suggest that QM programmes are particularly effective in terms of reducing costs. On average, for every £1 a business spent on a QM programme, costs were reduced by £16. QM programmes also yielded impressive RoI estimates for revenues, suggesting that for every £1 spent on a QM programme, revenues were increased by £6. The RoI estimates were drawn from independent case studies and all suggested that businesses gain more from their QM programmes than they spend on them. Hence, Cebr is confident that a typical business can anticipate a positive RoI from implementing a QM programme. Our confidence in this regard is added to by the case study responses of a quality excellence body. The excellence body found that, over the past seven years, across a sample of 830 businesses there was an average RoI of 19:1. More qualitatively, across all sectors, businesses consistently reported that QM systems had positive impacts on customer retention, customer satisfaction and employee satisfaction. These qualitative benefits link to the RoI benefit of higher revenues – ie increased customer satisfaction and retention induces consumers to buy more, pushing up revenues. They also link to the RoI benefit of reduced costs. Increased employee satisfaction decreases costs by discouraging absenteeism and encouraging workplace enthusiasm.

Overall, the literature review, case studies and survey data inputs all indicate that QM programmes have improved outcomes for public, private and voluntary sector organisations. The independence and consistency of these inputs means that Cebr is confident that the more intensive and longer-term use of QM systems creates more productive and successful organisations. This achieved the report's first aim: ascertaining the extent to which QM programmes enable organisations to become more efficient and productive. The three input sources were used to construct an economic model which estimated how far QM programmes (a) have already improved headline UK macroeconomic indicators – such as GDP, employment and tax receipts, and (b) have the potential to improve these indicators in the future. The model estimated that QM programmes have improved these indicators significantly and have the potential to improve them more in the future. This satisfied the second aim of the report: formulating quantitative estimates of QM's impacts on headline UK macroeconomic indicators.

#### References

173. Section 4 indicates that there were some notable points of divergence between the case studies and literature review. This simply suggests that some of the organisations which provided case studies were not typical of those which had been investigated by the authors of the papers in the literature review.
174. The model's findings were not compared to those of the literature review, case studies and survey. Such a comparison would have been redundant because the model – being built on inputs from the literature review, case studies and survey – will cohere with them by construction.
175. The findings relating to profits and stock prices only apply to private sector organisations.

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