

## USING LEAN SIX SIGMA IN BUSINESS SURVEYS: PRACTICAL EXAMPLE

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### 1 Abstract

The Lean Six Sigma (LSS) programme has proved a very successful driver of change and business process improvement in the Central Statistics Office (CSO) in Ireland since its introduction in 2010. This paper gives an overview of one of the first Lean Six Sigma projects carried out in the office, which proved extremely successful and one of the precursors of the introduction of the overall LSS programme in the CSO.

The paper gives an insight into the 12 week journey of applying a DMAIC (Define-Measure-Analyse-Improve-Control) framework to a Business Survey that operated under the process approach, and where clarity between the Collect Data and Analyse Data phases of the GSBPM was missing. It describes the actions taken towards improving the statistical processing and the controls put in place to ensure that the new process does not revert to former performance levels. The actual benefits attained from applying the changes are also mentioned.

As a conclusion, the paper shares the lessons we learned during this LSS Project in particular, and what we identified as further considerations to take into account when selecting and carrying out future LSS Projects in CSO.

**Keywords:** Lean Six Sigma Business Statistics, Statistical Production Process Improvement

### 2 Lean Six Sigma and the DMAIC framework

Lean Six Sigma is the combination of two different methodologies. “Lean” focuses on eliminating non-value added waste<sup>1</sup> from a process in order to streamline production, improve quality and gain customer satisfaction in the long term. “Six Sigma” is a business management strategy that uses statistical methods to measure the capability of processes to determine the usefulness of the process in achieving customer’s needs. One of the areas of six sigma concerns process variation to ensure that it is kept under strict control.

Lean Six Sigma uses a variation of the PDCA cycle known as the DMAIC framework “to improve processes and products”, to ensure that the customer/user needs are properly and accurately reflected in process design and operation.

DMAIC is a 5 letter acronym to represent the following steps in the lifecycle of an LSS project:

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<sup>1</sup> Waste is the term used to cover activities which are classed as not providing value to the customer (or the user in a NSI context)

- *Define* – Where the project team and sponsor reach agreement on the problem, scope, goals and targets.
- *Measure* – Data associated with the quality, speed or cost of the process process is collected so the current state can be thoroughly understood and the underlying cause can be identified.
- *Analyse* - A detailed analysis of the data collected in the previous step is carried out to pinpoint and verify the causes of the problem.
- *Improve* – Generate and pilot potential solutions to the problem, and, in some cases, carry out full implementation.
- *Control* – Complete the project work and handover the improved process and implement procedures and service level agreements to maintain the gains achieved through the LSS project.

### 3 The EHECS project

The Earnings, Hours and Employment Costs Survey (EHECS) is the official short-term indicator of earnings data across all sectors of the economy in Ireland. Data on earnings, labour costs, hours worked and employment are collected at an enterprise level for all categories of employees. This data is compiled and published on a quarterly basis.

Following a period of underperformance of the survey in terms of non-compliance with timeliness as regulated by Eurostat, a decision was taken by the Management Board to include EHECS as one of the areas to take part in a Business Process Improvement project. In early 2011 an EHECS Lean Six Sigma (LSS) project team was established comprising of staff from both the Data Collection Unit (DCU) and Results and Publications (RAP) sections, together with external support from the Quality Unit, a Project Sponsor and a Project Champion.

The DMAIC framework in terms of this project was defined by the following steps:

- *Define* - Outlined the process improvement scope that was consistent with customer demands and the organisation strategy. Developed a project charter specifying the problem and goal statements, and conducted a SIPOC<sup>2</sup> analysis.
- *Measure* - Established the key aspects of the existing process and collected relevant data. Develop process maps for the EHCES processes and identify what metrics and in which steps they were needed.
- *Analyse* - Established the root cause of the why we were not meeting our time deadlines and established the relationships between cause and effects.
- *Improve* – Made recommendation for process improvement and managing the changes.
- *Control* - Ensured process improvements were locked in.

#### 3.1 Define

The purpose of the define step was to establish clear goals and objectives. We developed a project charter which included problem and goal statements, the scope for the project and the customer deliverables. While it is very important to focus on defining what the problem is and what will be delivered at the end of it from a customer's point of view, it is of equal importance to identify what items will be considered to be in scope for the project to avoid project overrun.

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<sup>2</sup> SIPOC stands for Suppliers, Inputs, Processes, Outputs, and Customers.

The charter for this project set the goal of delivering provisional results within the required timeframe of T+10 weeks, while also improving the clarity and efficiency of the data collection process. Prior to this project provisional results had an average delivery data of T+ 11 weeks.

A SIPOC analysis was conducted as part of the define step. The purpose of the SIPOC was to outline the start and end of the process, to identify the key customers and suppliers, to identify the requirements of these customers and to establish the primary inputs and outputs. The SIPOC analysis initially focused on highlighting who our customers were (for both DCU & RAP) and established what our exact customer requirements were.

As part of this phase we also developed a Gantt chart with specific deadlines by which each phase of the DMAIC process would be completed. We found that when running process improvement projects it is necessary to keep a definite schedule for the project to be effective and avoid project fatigue.

### **3.2 Measure**

The measure step required the identification and development of a number of metrics for the EHECS production process to identify possible areas for improvement and evaluate their impact in the overall process.

In order to improve the clarity of the process it was critical that process maps were developed. These process maps helped define and describe the “as is” process and would prove an essential tool in implementing process improvement. A several process mapping workshops were held during which staff from EHECS DCU and RAP outlined the tasks they completed as part of the overall process, from Sample Selection to the Publication of the Quarterly Provisional release. These tasks were detailed in the form of a flow chart and the actual mapping exercise resulted in all members of the project team having a greater appreciation and understanding of the overall process together with their own role in that process.

The process maps were then verified by all staff in EHECS through the use of a section walkthrough of the map to ensure all tasks had been captured correctly. In order to measure the time spent on the various processes we also used a Gantt chart to outline the major steps in the process, their start time and their duration.

### **3.3 Analyse**

The focus of the analysis step was based around the metrics of time and quality. In order to resolve the timeliness issue we performed an analysis of bottlenecks and waste (non-value adding tasks) in the current process using a TIMWOOD<sup>3</sup> analysis. We consulted with the staff for their suggestions on how processes could be improved and where waste existed. We also collected data on how the process was performing (edits, response rates, response management, data cuts, etc) so that we could analyse the effectiveness of the various steps in the process and make an informed decision as to where waste could be eliminated.

Using the results of this consultation and analysis we drew up a Cause and Effect diagram to identify the possible causes of where time was being lost and what inefficiencies exist in the current process. In order to concentrate on the root causes which were affecting the timeliness we prioritised six possible causes and carried out

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<sup>3</sup> TIMWOOD is an acronym used to describe the classic seven wastes of Transport, Inventory, Motion, Waiting, Over-Processing, Over-Production and Defects

further analysis to see if we had enough data to resolve these issues. While we already had quite a lot of data, we collected additional information on the Root Causes where we felt was necessary. Based on the analysis of this information we were able to come up with a list of recommendations to improve the process going forward. The main issue to emerge from the analysis was that there was little improvement in response levels after T+6 weeks and that the tests of production of results on data from T+6 weeks versus T+10 weeks showed minimal variation.

### 3.4 Improve

Following the Analysis step we came up with the following recommendations to improve the EHECS process:

- **Filing & Paper in Section** – EHECS Form B's will not be brought to section after scanning and verifying – they will instead be stored centrally. A reorganisation of filing system for Form A was recommended.
- **DCU-RAP Relationship** – Service Level Agreement (SLA) to be drafted to improve clarity of file handover process
- **QNHS Employment Data** – RAP to use previous Quarters QNHS Employment Data which will remove potential waiting period in production of EHECS release
- **Import Process and Reports** – Data to be imported by supervisors in section. Supervisors to receive training on Data Import process. Automate and schedule SAS reports where possible.
- **Key Company List** - A list of key companies by Sector/Allocation will be drawn up to assist in prioritising Respondent Management and Edit queries. This list will also be made available to RAP as part of SLA.
- **Section Manual & Guidelines** – Section manuals to be updated reflecting the steps detailed on the relevant Process Maps. Guidelines to issue to staff for Edit Management and Response Management which will incorporate the best practice highlighted in recent section workshops.
- **Interim Warning letter** – Interim Warning letter to be drafted for issue to key companies with history of continuous non response.
- **Response Management** – Stop practice of contacting companies who we know will not respond and who are not detailed on the key company list.

In addition to all the above there was a **key recommendation** made that would be essential to reduce the timeliness in the transmission of data to Eurostat and achieving the project goal as set out in the project charter.

This required DCU to provide provisional data to RAP at T+6 weeks (T+14 weeks for final data) in contrast to the T+10 weeks (T+20 weeks for final data) previously being used for handover. A full paper release would be issued at T+8 weeks thereby satisfying the requirements of both National Accounts and Eurostat. However because of the early release date it would not be possible to include tables on Employment data as QNHS data would not be available within that timeframe. EHECS final data would be made available on the databank at T+15 weeks. This recommendation was tested as a proof of concept using live data for Q1 2011 (Provisional data) and Q4 2010 (Final data). The pilot was successful and a decision was then made to fully implement the recommendation from the following quarter (Q2 2011 Provisional).

### 3.5 Control

In order to ensure that the improved timeliness in maintained a number of controls were put in place on an ongoing basis including:

- Creation and maintenance of a Service Level Agreement between DCU and RAP
- Use of charts in section to record Response Rates by Sector on a weekly basis
- Use of quality checks on a day to day basis to identify outliers on a Sectoral level
- Development of updated Section Manuals and Guidelines
- Update the process mapping to reflect the new improved process

## **4 Benefits**

An evaluation of the project after its completion showed that it was viewed as a very worthwhile exercise by all staff involved, in particular with regards everyone being able to take ownership and have more input into how processes are carried out. It also translated into an improved level of clarity for the specialised staff, diminishing the divide that had been introduced by using a process approach.

The improvement in timeliness placed by the key recommendation made during the Improve phase was extraordinary: Provisional data would be published at T+8 weeks and Final Data would be published at T+15 weeks. This will translate into a saving of 3 weeks (8 weeks v 11 weeks) on the publication of provisional data and a saving of 9 weeks (15 weeks v 24 weeks) on the publication of final data.

A side effect of the issues addressed during the project came in the shape of staff savings: after the introduction of the new measures the number of staff required to run the survey was decreased by 33% without having an impact on the data quality, which still increased showing that the level of edits and/or partial non-responses was reduced by 15%.

## **5 Lessons learned**

The EHECS LSS project provided an excellent framework to review our existing work practices, to highlight potential issues and waste in our processes and to gather relevant information to support the decision making process. It resulted in all the section having a greater appreciation and understanding of the overall process, together with their role in that process. By using the DMAIC and SIPOC tools we all became clear on what the needs of our customers actually were and this in turn allowed us to focus on meeting these needs. It also provided staff in the section with more ownership of the process and allowed them to make a contribution to the future improvement in the way the section does its work. While the project took up more time that was originally expected, it was time very well spent as we all could see the benefits to both the section and our customers. The Quality unit also played a very important role in the overall process as they provided an external, independent and alternative view which benefited the project greatly.

## **6 Current status**

It is now 6 years since the completion of this project and the EHECS has not undergone a further full review as of yet. During this period a number of the recommendations have been carried out on an ongoing basis:

- Periodic reviews of the performance are conducted, including a yearly review of the SLA between DCU and RAP, and the agreement of handover dates for the year

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- The use of visual tools in the shape of charts and graphs to evaluate the performance of the survey
- Continuous use of quality checks for early outlier detection

In addition to that, the extra clarity in the process has freed up yet more staff allowing our RAP section to disseminate extra items:

- Job Vacancy statistics are now transmitted regularly to Eurostat
- Seasonally adjusted data is published nationally for all sizes and classes involved
- The publication is now done at the 2 digit NACE classification rather than one digit only
- Figures on Benefit In Kind are also published

The existence of process maps and spare capacity have allowed staff to focus on changing certain procedures and automating a number of processes, thus generating extra efficiencies, which in turn have rendered extra resource savings. At the time of writing this paper the DCU was running with 40% less staff compared to its pre EHECS LSS days.