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STATISTICAL PROCESS CONTROL IN OFFICIAL STATISTICS

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Abstract: *The concept of quality control is becoming more and more important in the field of official statistics. In the last decade many national institutes of statistics adopted a systematic approach to quality. The paper deals with the issue of applying the concept of statistical process control (SPC) to official statistics. Process approach allows developing and improving the effectiveness and efficiency of a quality management system to meet the needs of all stakeholders. In the paper we focus on:*

- Identification of statistical processes and establishment of links between them and

- Tools and methods for managing the statistical processes.

Keywords: OFFICIAL STATISTICS, STATISTICAL QUALITY CONTROL, STATISTICAL PROCESS CONTROL, QUALITY CONTROL

1. Introduction

Official statistical data is of paramount importance in assessing economic, social, cultural or environmental issues and plays a crucial role in building polices both at macro and micro level. Unlike the private business which became aware of the importance of quality management more than 50 years ago, it has been since several years an increased awareness of the importance of quality work in the national statistical institutes. Eurostat (2017), OECD (2017) and other national statistical offices have identified various sets of data quality components and have adopted a system of quality management to improve their organizations and the quality of the data produced.

Until fairly recently the quality of statistical output has traditionally been viewed in terms of accuracy. However, quality as employed in other activities has generally included broader interpretations According to Forbes and Brown (2012) official statistics "need to be used to be useful". Eurostat (2017) proposed a definition on quality which encompasses several issues (relevance of statistical concept, accuracy, timeliness and punctuality in disseminating statistical results, accessibility and clarity of the information, comparability and coherence and completeness) and as such is appropriate for official statistics. The OECD uses seven dimensions for quality assessment: relevance, accuracy, timeliness and punctuality, accessibility, interpretability, coherence, and credibility.

Fig. 1 *Working principle of 3D the printer EOSINT M 270*[1].

2. The difference between statistical quality control and statistical process control

Although the main principles of the different quality management systems are common, there is a difference in conceptual purpose applied to the use of such systems. The traditional quality control focuses on the product. It monitors the product quality and reworks or scrap off-spec product. "Statistical process control (SPC) is a powerful collection of problem-solving tools useful in achieving process stability and improving capability through the reduction of variability." (Montgomery, 2009) So, SPC focuses on the process, and not on the product. SPC is a strategy that focuses on quantifying, classifying, and reducing variability in the process. It is based on the philosophy that making the right product in the first place is better than trying to rework the wrong product.

What are the benefits of adopting and implementing SPC? SPC provides surveillance and feedback for keeping processes in control. Statistical techniques provide an understanding of the business baselines, insights for process improvements, communication of value and results of processes, and active and visible involvement. SPC provides a mechanism to make process changes and track effects of those changes to establish controllable process baselines. Once a process is stable (assignable causes of variation have been eliminated), SPC provides process capability analysis with comparison to the product tolerance. So, SPC optimizes the amount of information needed for use in making management decisions and focuses management on areas that really need improvement. These benefits of SPC cannot be obtained immediately by the national statistical institutes. SPC requires defined processes and a discipline of following them. Above all it requires a strong management commitment.

3. Identification of processes and defining quality standards

The key steps for implementing Statistical Process Control are:

1. Identify the processes;
2. Identify measurable attributes of the process;
3. Characterize natural variation of attributes;
4. Track process variation;
5. If the process is in control, continue to track;
6. If the process is not in control;
7. Identify assignable cause;
8. Remove assignable cause;
9. Return to "Track process variation".

In the production of the statistical output a number of processes are performed sequentially. "Processes are first defined and classified according to their different nature, e.g. statistical vs. organizational ones, taking into account both the management control literature and the UNECE Generic Activity Model for Statistical Organizations (GAMSO)". (Brancatoet. al, 2016).

The phases of the statistical business process (statistical value chain or statistical cycle) are best described by the "Generic Statistical Business Process Model" (UNECE, 2017). It is based on the Generic Business Process Model of Statistics New Zealand and Statistics Canada. However, a number of other related models and standards exist. The relationships between these models are depicted in Figure 1.

After the processes have been identified, the next step is "to define a set of quality characteristics applicable to the statistical processes and sub-processes and to some organizational processes… They are the pillars for the further definition of measures to monitor quality and performance and to assess them against given targets." (Brancato et. al, 2016)

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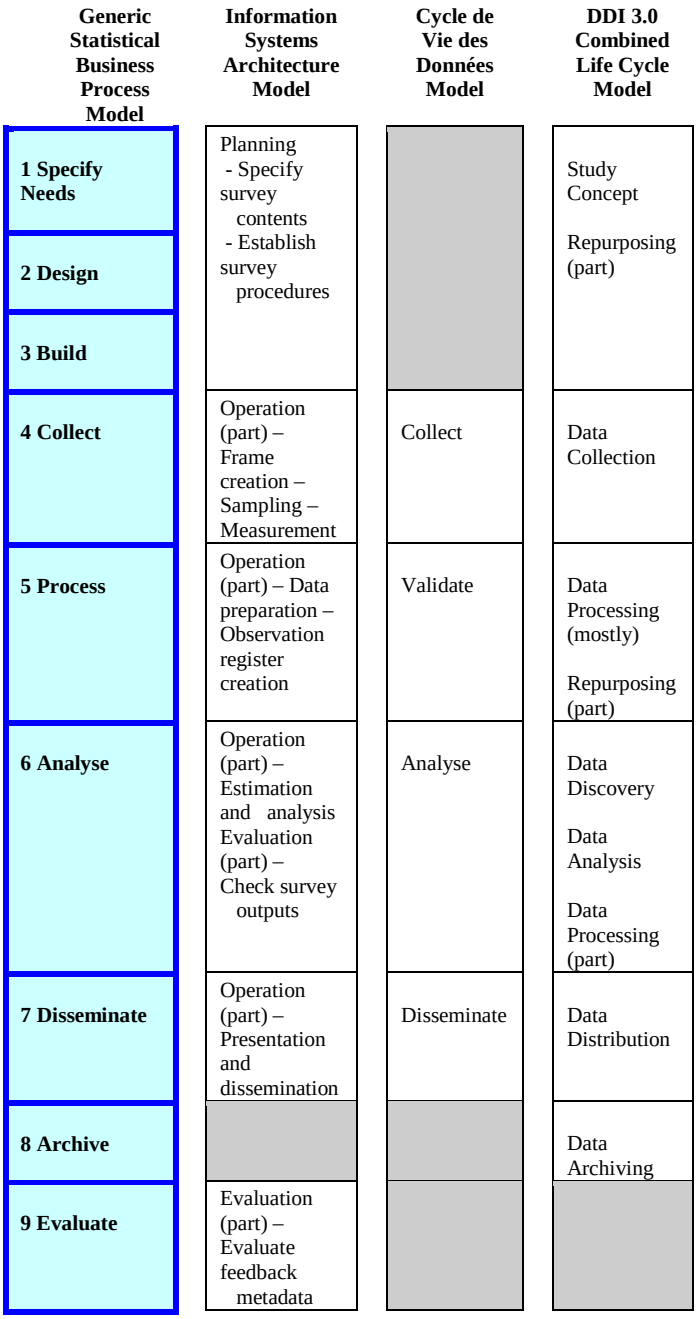

Figure 1: Relationships between statistical business process models (Source: UNECE)

A quality standard should be specified for each process. The standard is a minimum base which can be refined and revised through time on the basis of the obtained feedback about its strengths and weaknesses. It has two objectives: 1. To inform the managers of NSI about the efficiency of resources spent to attain optimal allocation and 2. To inform users about the risk involved in making decisions based on the different statistical products.

The quality standards for the producers (NSI) should include: description of the process and inputs in the process, list of the processes that result from that process, what are the necessary skills for operation of the process, metrics for measuring the performance of the process, what should be done if a standard is not being achieved, the name of the person who can change the process and a change control procedure for modifying the process. (McKenzie, 2006) The standards for the statistical production processes should be specified in the framework of the statistical design phase which covers several processes (sample design, response rates, imputation and estimation). The main tool for monitoring of quality of statistical production process is self-assessment by the operational managers who should also develop quality standards for administrative processes. (McKenzie, 2006) The quality standards for data management processes should be built into the production system which should provide metrics that allow the operator to assess whether the standard for the process has been completed correctly. In monitoring and decision making processes quality standards should be clearly specified. The standard should define the minimum response rate required for each category and the key respondents from which a response must be received. The analytical stage of the process model is an area where the "inspection" that is the bane of the quality management gurus cannot be avoided. It requires more human judgement so it will be more difficult to set up standards.

4. Conclusion

In the last several years most of the national statistical institutes (NSI) worldwide have worked very hard on developing quality management strategies. One of these strategies is the statistical process control (SPC). In this paper we have presented the phases in the process of adoption of SPC by official statistics, focusing on the first and the most important phase -the identification of the statistical processes. We have also presented the proposed list of statistical quality standards for these processes.

The most important lesson to be learned from SPC is its basic idea of shifting the emphasis of quality thinking from a single statistical product to the whole statistical process and wider to the whole management process of NSI. Activities of NSI should be seen as processes where the needs of the customers on the one hand and the capabilities of the staff on the other hand play the crucial role. Successful adoption of SPC requires not only identification of the processes, but a discipline of following them and above all a strong commitment from the top management of NSI.

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