The use of Quality Gates in a Statistical Review System

Adapted for the requirements of the Statistical System of Afghanistan

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Abstract:

This document describes an approach to improve the quality of products in statistical processes

The subject will be to describe Quality reviews supported by Quality Gates (Best Practice from the Australian Bureau of Statistics. The solutions of these two statistical offices seem to be specially attractive and adaptable to the conditions of Afghanistan:

1. No national Quality Assurance system for Statistics is yet in place
2. CSO and Ministries need to find a new position in the social and political system of the country
3. The approach is tool based but does not involve heavy administrative overhead
4. Tools are easy to perceive, adapt and implement

Quality gates are designed to improve the early detection of errors or flaws in production processes. Specifically, the principles that underpin the quality gates framework are:

- Quality of statistical processes should be managed in a holistic manner i.e. Total Quality Management;
- Quality management and assessment of fitness-for-purpose of statistical processes should be evidence based;
- Any problems arising in statistical processes should be detected as early as possible;

The proposal is based on the approach of the Australian Bureau of Statistics (ABS), Australia's official statistical agency. It is committed to leading a high quality statistical service to assist and encourage informed decision making. This attitude is encouraged for the Statistical System of Afghanistan (SSA) as well. A key function of the ABS is to provide statistical leadership in developing and assisting to implement standards used in statistical processes undertaken by official bodies. Again this is a goal for the role of CSO in the SSA. CSO will only succeed in this task if the products and processes offered apply high quality standards, if the signature of CSO as a professional peer among the stakeholders is recognized for its high standards. This working paper will try to contribute to describe tools feasible and necessary to attain these goals.

Introduction

Statistical collections are often exposed to the risk that one or more of the components of the process fail to meet the quality standard expected, such that the quality or the integrity of the statistical outputs are affected. In this paper we refer to this kind of risk as "statistical risk". Statistical risk arises for various reasons, some of which may include inadequate inputs, processes not being well defined, changes to existing processes, or human error. The purpose of this paper is to introduce a new approach to managing statistical processes. This framework provides a systematic approach for assessing the quality of the statistics at specific points in the process, such that the overall qualities of outputs are fit for their intended purposes. Agencies involved in collecting, processing, analysing or disseminating statistics will be able to apply the framework for mitigation against statistical risks in statistical processes.

Quality gates can be used to improve the visibility of quality in the production process as well as being used to measure and monitor quality in real time at strategic points. Quality gates consist of a set of acceptance criteria imposed at predetermined points in a production process whereby each of the components (Placement, Quality Measures, Roles, Tolerance, Actions and Evaluation) play an important part in determining the fitness for purpose of the process.

Quality gates are designed to facilitate the detection, discussion and resolution of issuesand problems through a collaborative effort to improve the quality of products.

- Any problems arising in statistical processes should be detected as early as possible;
- Roles and responsibilities in the management of process quality should be clear and explicit
- Knowledge and information about specific stages of a statistical process should be documented and shared; and
- Regular evaluation should capture lessons learnt and lead to continuous improvement of quality management of statistical processes.

Six components of Quality gates

Quality gates can be used to improve the visibility of quality in the production process as well as being used to measure and monitor quality in real time at strategic points. Quality gates consist of a set of acceptance criteria imposed at predetermined points in a production process whereby each of the components (Placement, Quality Measures, Roles, Tolerance, Actions and Evaluation) play an important part in determining the **fitness for purpose** of the process.

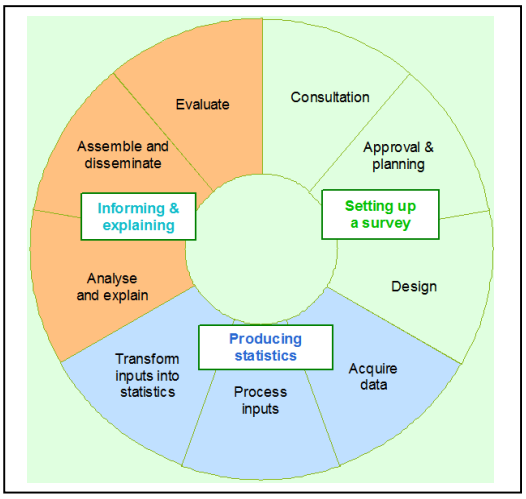
Quality gates are designed to facilitate the detection, discussion and resolution of issues and problems through a collaborative effort to improve the quality of products.

Placement

"Placement" is the first component of a quality gate. It refers to the placement of quality gates throughout a statistical process (also known as a business process cycle, or statistical process cycle). Placement of a quality gate is determined by the level of risk associated with given points in the production process. Specifically, the placement of a quality gate should occur where a risk assessment of the process reveals that there is a need for a quality gate due to the impact on the process and statistical outputs that would occur if the risk was realised.
In determining where to place quality gates it is important to ask the questions:

- What can go wrong?
- When can it occur?
- What impact can it have?

The statistical risk which could be either Low (L), Moderate (M), High (H) or Extreme (E)



Let us look at a simplified business model of statistical production:
In the SSA there are also other processes than surveys so in general terms we can divide the processes in :

- Input
- Process and
- Output

By identifying the key activities associated with each step of the statistical process, an assessment of whether there are any risks in those steps can be made up front.
This assists with determining where best to place quality gates.
Some common risky areas in a process include:

- Hand-over or integration of data between multiple areas
- Data transformation; and
- Changes to processes, methods and systems.

It is important when considering placement of the quality gates that each gate is placed as early in the process as possible to allow early detection of issues. This promotes greater efficiencies as errors are picked up earlier in the process and resolved in a time. However, when positioning quality gates the impact of time constraints on the overall production of the statistics needs to be taken into account. This means that there is should not be too many of quality gates that can be effectively implemented..

Quality measures

The second component of a quality gate is "quality measures".
Quality measures are a set of indicators that provide information about potential problems at a given point in the process. When determining what quality measures should be included in a specific quality gate it is important to consider the risks and what information would be required in order to make an assessment about fitness for purpose at that point in time. That is, which quality measures are going to reveal if there is a problem with the process?
Along with thinking about the immediate needs of the process it is important to keep in mind the outcomes that are required from the process to ensure that these can be met through use of appropriate quality measures.

Using common or shared definitions where possible for quality measures is encouraged. Where a common definition is not appropriate it is important to ensure that the quality measure is thoroughly documented so that no misunderstandings occur. Often simple errors occur in processes because common knowledge of that particular process is assumed to be held by all parties involved.

> Note that a quality measure may not itself identify a specific problem in the process but it will report on symptoms which may indicate that something is not right and further investigation is required.

Documenting the definitions used for the quality measures is an important part of knowledge management for a quality gate. Historical information of the process can be used to determine if there are any known issues that should be monitored along with the initial risk assessment. So the statement, that there is little administration involved is maybe too optimistic.

It is also important to note that the source of a quality measure may be different to the source of the problem. When thinking about quality measures it is useful to also consider what it is about the process that they are revealing as it may not be a straight forward one to one link. Not every detailed check that is undertaken in a process will constitute an individual quality measure, however they may be utilised by quality measures. An example of this is a check list of the different ways a data set is validated (e.g. internal consistency checks, non-zero values, number of records in is equal to number of records out) which may not in itself be a quality measure but combined with other detailed checks it may form a part of a quality measure. As with any monitoring activity it is useful to prioritise the quality measures in terms of their level of importance in ensuring the quality of the process. This is because quality gates are labour intensive and there is a cost to benefit trade off assessment that needs to be made in order to achieve high quality outputs in a timely manner.

That is why it is important to choose good indicators (quality measures) of potential problems. The identification of good quality measures will become more apparent with experience and practice in using quality gates over time.

Roles

The third component of a quality gate is "roles". This component involves assigning tasks to various people or areas involved in the operation of a quality gate. Roles identify areas or people who are directly connected to the quality gate and its operation, along with people or areas who are affected by issues with the process. It is important to make sure that people or areas dependent on the successful outcome of the process, who are not directly involved, are included in roles as stakeholders. This is so they can be informed of any issues identified from the quality gates that may impact on their work. The key roles for a quality gate have been identified as:

- An operational person (gate keeper);
- Stakeholders; and
- A sign off person

(A sign off person is **independent** of the compilation of the quality gate. They examine the information presented within the quality gate and make a decision as to whether the process can proceed to the next stage – In an initial stage a consultant from an external project –best to be even external from the checked project – could initiate this role)

Tolerance

"Tolerance" is the fourth component of a quality gate. Tolerance refers to an acceptable level of quality. The acceptable level could be qualitative (e.g. Yes/No) or quantitative (e.g. 90%).

Actions

"Actions" is the fifth component of a quality gate. Actions are predetermined responses to various outcomes for a quality gate. They provide a definition of what will be done if threshold or tolerance levels are met or not met with regards to each quality measure. In particular the actions associated with each quality measure need to take into account the severity of the result on the end product or other quality measures and gates if the threshold or tolerance levels are not met.

Questions which may help clarify the actions to take for a quality measure depending on the tolerance levels are:

- What needs to be done if there is a problem?
- Who needs to be informed?

A suggested way of determining the actions to take is to consider a traffic light (Red, Amber and Green) and the subsequent degree of severity of the action depending on the colour of the light. The traffic lights will correspond to a tolerance level that determines the level of acceptability.

The traffic lights and their potential actions are:

- Green light: occurs when the threshold or tolerance levels have been met and there are no issues with the process at that point in time. This indicates that processing can move to the next stage.
- Amber light: occurs when the threshold or tolerance levels indicate that there may be a problem. This might be that the level achieved for a quality measure at that particular point in time is slightly outside the range of the predetermined level of acceptability. It is advised that investigations should occur to determine if there is a problem or not and to continue cautiously to the next stage of the process whilst the investigation is underway. The amber investigation should ensure that if there is no problem with the process or data that the unexpected result is explained fully.
- Red light: occurs when the threshold or tolerance levels are not met. That is, major problems are identified with the process. This means that the process must stop so that the problems can be investigated and resolved before proceeding to the next step. This may involve returning to the last known place in the process where everything was okay (i.e. the last quality gate with green light) and processing the data from that point forward. This would include applying the required fixes to ensure that the process is correct at the next quality gate.

Evaluation

The final component of a quality gate is Evaluation. As with any process that is undertaken an evaluation or review should occur to examine where improvements can be made for future use.
At the end of each statistical process cycle is it recommended that the quality gates should be evaluated to determine what worked well, what didn't and where improvements can be made. It is useful to consider whether the information provided by the quality gates provided enough information to make informed decisions. Potential improvements for quality gates may include but are not limited to:

- An assessment of the benefit of all the quality measures within each quality gate compared to the cost of having them (!). This is very important
- Adjustments to tolerance levels;
- The addition of quality measures not specified previously;
- The removal of quality measures not considered useful;
- The removal of a quality gate because it does not add value or is not required; and
- An adjustment to all of the components of a particular quality gate based on the experience of the process of using them.

The benefits of implementing quality gates outweigh the initial costs associated with their creation. Some of these benefits include:

- The provision of a model of accountability and responsibility for production processes;
- The ability to detect problems early on in the process so they can be rectified;
- Predetermined expectations of acceptable levels of quality;
- Documentation and monitoring of issues and actions throughout the production cycle; and
- The creation of a store of corporate knowledge.

Implementers of quality gates within the ABS have identified issues that should be considered when developing quality gates. The issues that have been identified for consideration are:

- Dedicated resources for the review and development of quality gates;
- Limiting the number of quality gates;

- Eliminating duplication of gates;
- Quality measures should be mutually exclusive;
- Consultation with stakeholders; and
- Placement of quality gates at critical control points.

The below templates are for consideration when developing a quality gate. They provide a structure that can be used to help in the monitoring and documentation of quality gates. Not all sections of the template may be applicable. It is up to each individual to determine what is appropriate for their circumstances.

Checklist for a quality gate

1. Simple business process map of process (like graph)
2. Placement
3. Risk assessment of process
    - What can go wrong?
    - When can it occur?
    - What impact can it have?
4. Quality Measures
    - How would we know if something was wrong?
5. Roles
    - Who is responsible?
    - Who will this affect?
6. Tolerance
    - What is an acceptable level of quality?
7. Actions
    - Traffic light concept
    - What will we do if there is a problem?
    - Who needs to be informed?
8. Evaluation
    - What has this information told us about our quality?
    - How can we improve in the future?

Annex I Document Template for Quality Gates

(to be adapted on demand):

Definition of Quality Gate:

Quality Gate Definition Document				
Quality Gate Name:				
Placement*:				
Quality Measures	**Source ****	**Due Date**	**Complete (Yes/No)**	**Comments / Changes [Evaluation]**
* Placement should be linked to business process model / statistical process cycle				
** Source should indicate where to locate the quality measure				

Quantitative Quality Measures: A Template

Quality Measures Definition Document - Quantitative Quality Measures (e.g. 97%)		
Name of Quality Measures		
Description		
Why we need the measure	[What aspect of the process / collection does this measure tell us about that we wouldn't otherwise know?]	
Where		
Quality Gate	[What quality gate does this measure feed into?]	
Level	[What level of detail do we require this measure at? e.g. Industry sub-division, state, local government, etc.]	
Calculation		
Formula	[How is the measure calculated?]	
Frequency	[How often does this measure need to be calculated? e.g. daily, weekly, monthly, etc.]	
Scope	[Are there any specific inclusions or exclusions from your measure?]	
Reference	['Is there a paper that provides more information / background on this 'definition'?]	
Standard	[Is the formula and definition a standard used by the organisation or an international organisation?]	
Data Items used in formula	Description	Source / Availability
[name]		
[name]		
[name]		
[name]		

Presentation of quality measure	
Monitoring	[How are you going to 'track' the quality measure to see if everything is okay? e.g. percentage change from one period to another, trend over time, etc.]
Frequency	[What is the frequency that we wish to use in our monitoring / display for reporting?]
Display	[How are we 'displaying' the Quality Measure? e.g. graph, table]
Tolerance	[What are the threshold or tolerance levels for this quality measure and when is the measure being assessed against these?]
Actions	[What are the actions that need to be taken depending on the quality measure and where it fits within the tolerance? i.e. Red, Amber and Green actions.]
Roles	
Owner Area / Gate Keeper	[Who is responsible for monitoring this quality measure?]
Provider Stakeholders	[Who are the people or areas responsible for providing the information that feeds into this quality measure, or providing the quality measure? This includes those persons responsible for the calculation as well.]
Other Stakeholders	[Who or what areas may need to be contacted if there is a problem identified with the process by this quality measure?]

Qualitative Quality Measures: A Template

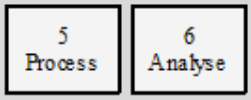
Quality Measures Definition Document - Qualitative Quality Measures (e.g. Yes/No)	
Name of Quality Measures	
Description	
Why we need the measure	[What aspect of the process / collection does this measure tell us about that we wouldn't otherwise know?]
Where	
Quality Gate	[What quality gate does this measure feed into?]
Level	[What level of detail do we require this measure at? i.e. what checks feed into this quality measure?]
Tolerance	[What are the threshold or tolerance levels for this quality measure and when is the measure being assessed against these?]
Actions	[What are the actions that need to be taken depending on the quality measure and where it fits within the tolerance? i.e. Red, Amber and Green actions.]
Roles	
Owner Area / Gate Keeper	[Who is responsible for monitoring this quality measure?]
Provider Stakeholders	[Who are the people or areas responsible for providing the information that feeds into this quality measure, or providing the quality measure?]
Other Stakeholders	[Who or what areas may need to be contacted if there is a problem identified with the process by this quality measure?]

Annex II Examples of Quality Gates Documents from ABS

Quality Gate Definition Document

Quality Gate Name: QUALITY GATE NUMBER 5

Placement*: Falls within the 'Process' and 'Analyse' sections of the business process model



Quality Measures	Source **	Due Date	Complete (Yes/No)	Comments / Changes [Evaluation]
QM1 - percentage change key series	s:/section drive/quality gates 5/QM1	30th September 2010		28/09/2010 QM1 has not been finalised yet. Currently an Amber light. Investigating a larger than expected change in data items
QM2 - validation of publication	s:/section drive/quality gates 5/QM2	20th September 2010	Yes	

* Placement should be linked to business process model / statistical process cycle

** Source should indicate where to locate the quality measure

Quality Measures Definition Document - Quantitative Quality Measures (e.g. 97%)		
Name of Quality Measures	QM1 - Percentage Change Key Series	
Description	Percentage change from 2009 to 2010 of key series of interest	
Why we need the measure	This measure helps to ensure consistency of data with previous releases and ensures that any unexpected increases or decreases are investigated to ensure it is a 'true' movement and not an error in the process.	
Where		
Quality Gate	Quality Gate 5	
Level	Each of the below key series: Data Item A Data Item B Data Item C Data Item D cross classified by State / Territory; State / Territory x Industry	
Calculation		
Formula	Percentage change = ((current - previous)/previous))*100 e.g. ((data item A 2010 - data item A 2009)/(data item A 2009))*100	
Frequency	The measure will be calculated once the data has been processed.	
Scope	No there are no exclusions to the key series that need to be mentioned.	
Reference	Not applicable.	
Standard	Not applicable.	
Data Items used in formula	Description	Source / Availability
Data Item A	Data item A is an input item from the collection.	
Data Item B	Data item B is compiled from questions 29 and 30 of the collection. Please see: S/section drive/Data Items/ for more information on the questions and their combinations into the data item.	
Data Item C	Data item C is an input item from the collection.	
Data Item D	Data item D is an input item from the collection.	

Presentation of quality measure	
Monitoring	We will use a percentage change from the previous year's release. We will compare this with the previous 5 years worth of percentage changes in these series to observe the appropriate tolerance levels.
Frequency	A time series of the last 5 years worth of these percentage changes.
Display	The Quality Measure will be displayed in a spreadsheet which will have a formula that will identify those percentage changes that are outside the appriopriate tolerance levels.
Tolerance	A percentage change of between 0-7% inclusive is Green light A percentage change of between 8-14% inclusive is Amber light A percentage change of between 15-22% inclusive is Red light
Actions	Green light = no action; everything is okay Amber light = investigate the slightly larger than expected movement to determine if it is a real world effect or an error with the process somewhere. Red light = stop the process and fix the problem. This includes: investigating where any changes have occured to the system, processes or methodologies from last time; check data inputs; etc. For more information on the contingency strategy please see: s:/section drive/quality gate 5/Actions/QM1
Roles	
Owner Area / Gate Keeper	Victoria in the business area responsible for the process.
Provider Stakeholders	* Andrew in the business area for data item A and its corresponding cross classifications * Kate in the business area for data items B and D and their corresponding cross classifications * Paul in the business area for data item C and its corresponding cross classifications * Emma in the business area as the sign off person
Other Stakeholders	* Tanya in the analysis area who utilises the data from our collection and has a report due out in one month * Kettie from the support area who is extracting data from our file for a data request

Quality Measures Definition Document - Qualitative Quality Measures (e.g. Yes/No)	
Name of Quality Measures	QM2 - Validation of Publication
Description	This quality measure checks that all internal consistency are correct i.e. that the same total in various table within the publication are identical.
Why we need the measure	This quality measure ensures that the publication is correct. It will also highlight if there are any possible errors in the calculation and derivation of any publication tables.
Where	
Quality Gate	Quality Gate 5
Level	* Internal validation of tables - see: s:/section drive/tables/validation/tabledocument (for more detail on the checks undertaken). * Validation of derived items - see: s:/section drive/tables/validation/derivedtemsdocument (for more detail on the checks undertaken). * Written articles in the publication checked for spelling, grammar and numerical correctness.
Tolerance	Tolerance is zero. That is there can be no differences in the numbers provided for the same data item. Green = no difference between the same data items Red = at least one data item does not match itself
Actions	Green light = continue the process Red light = STOP! Investigate the data item(s) with the error. Check any changes; check derived items, etc. Please see the contingency plan strategy for the checks and processes that will be implemented to fix the error. Found at: s:/section drive/tables/validation/quality gate 5/Actions/QM2
Roles	
Owner Area / Gate Keeper	Victoria in the business area responsible for the process.
Provider Stakeholders	* Emma in the business area as the sign off person * Elizabeth from the business area for doing the internal validation of tables and written articles check * Stephen from the business area for doing the compiled items
Other Stakeholders	* Tanya in the analysis area who utilises the data from our collection and has a report due out in one month * Kettie from the support area who is extracting data from our file for a data request

Annex III Examples of Quality Gates Documents from SSA Afghanistan

These are to be developed and included here