THE ROLE AND MANAGERIAL ISSUES OF INFORMATION TECHNOLOGY IN STATISTICAL DEVELOPMENT

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Abstract - *In the rapidly changing world and in the globalizing era, the global focus on statistics is increasing. The National Governments realized that the right use of better statistics is essential for good polices and development outcomes. This recognition requires more accurate and timely statistics supported by new information technology environment. Moreover, a national statistical institution is a large data warehouse containing primary data such as data on persons, enterprises and administrative units, and compiled data and information in the form of statistics covering most sectors of society. Statistics are based on both data collected directly by the statistical institution and to an increasing extent on data from administrative registers. Use of information technology is crucial both for data collection, compilation, storage, analysis, presentation and dissemination of statistics, and technology is today the backbone of our activities. This research work examines the role and managerial issues of information technology in statistical development.*

Keywords: Data, Information, Statistical development

1. INTRODUCTION

In recent years, with the rapid development of information technology and its application widely among various areas of the society, official statistics department in Nigeria has been applying a variety of information technologies to the work of Statistics. Now great success has been achieved in improving the quality of statistical data, and it's significant for improving the capacity and credibility of Government Statistics.

Statistics is a profession related to information. Therefore, the success of statistics depends on the way in which we are able to collect, process, safeguard and disseminate this information. Having entered the 21st century, the management of statistical information is unimaginable without a support of adequate tools of modern information technologies.

The last two decades witnessed an important move towards statistical information systems that integrate the tasks throughout the statistical activity, whether it is a census or survey. Leading statistical offices integrate the data repositories and processing systems, harmonize the tools used, with a view of having efficient, transparent and easy to maintain systems. This is the general trend in statistical offices at present.

However, the integration of statistical information systems requires taking into account various specific needs of individual phases of data processing, and in various subject matter contexts. Therefore, creators of the integrated statistical information systems need, as a first step, to create a model describing the functions of the statistical offices (Juraj Riecan, 2013).

Information Technology (IT) is a vehicle with great potential to improve or accelerate the developmental process of any developing nation. IT can be examined as a system within a specialized framework to achieve particular tasks or objectives. From the functional perspective, IT can be set up to actualize the specific objective of collecting, storing, analyzing, and presenting data/information in a systematic manner. Structurally, information technology is composed of vast interrelated components that include a combination of data, technical, and human or personnel resources. It can also be viewed as being made up of input, processing, and output sub-systems, all working according to a well-defined set of operational procedures. Information Technology is one of the driving forces of globalization by fuelling the rapid transformation of remote and isolated information units into global interconnected superhighways. In addition, it is a transforming mechanism that can influence the way we live by converting our societies into truly knowledge based ones thereby leading to society equity (Sefiu Taiwo Oloruntoyin and Ibrahim Adepoju Adeyanju, 2013).

Data/Information is a vital key to national development and is a sine qua non in all phases of development from the birth to death. Today, the world, most especially

developing countries like South Africa, Ghana, and Nigeria, have witnessed an info-technological revolution that has given birth to effective data flow, computer inter-connectivity and the ability to go beyond the national boundaries. The statistical system of a nation have a lot to benefit from the existing information technologies such as personal computers, statistical packages, internet access, e-mail, among others. In the light of this, a central theme for statistical development is the effective convergence of developmental data through appropriate information technologies in the society (Sefiu Taiwo Oloruntoyin and Ibrahim Adepoju Adeyanju, 2013).

A national statistical institution is a large data warehouse containing primary data such as data on persons, enterprises and administrative units, and compiled data and information in the form of statistics covering most sectors of society. Statistics are based on both data collected directly by the statistical institution and to an increasing extent on data from administrative registers. Use of information technology is crucial both for data collection, compilation, storage, analysis, presentation and dissemination of statistics, and technology is today the backbone of our activities (Hans Viggo, 1997).

Different tasks require different types of technology; technology that changes rapidly and provides new possibilities and challenges. It requires experience that has to be renewed all the time and represents a major item in the budgets. New technology does not always function as expected, and there are many examples of developments which have not been a success. Management and organisation of information technology have therefore been put on the agenda in most statistical institutions (Hans Viggo, 1997).

Statistical work and modern information technology

Statistical work essentially is to provide comprehensive, accurate, timely and authoritative data for the country, in order to know the economic and social changes well, closely monitor the health of the economy and society, and reveal problems accurately. Therefore, Statistical work is basis of governmental scientific decisions. However, facing tens of thousands of statistical indicators of social, economic, technological and environmental and hundreds of millions respondents, it is impossible to collect, transmit, store, process and analyze data quickly and efficiently without the tools of modern information technology. For example, if a more comprehensive GIS-based spatial information system can be built, it can provide more scientific sample frames for urban and rural household survey, reducing the number of census, which will greatly promote the integration of urban and rural household surveys and quality of demographic work. In a word, in modern society, any step and any aspect of the scientific development of statistical work are subject to the full application of modern information technology (Ms. Shi Fangchuan, 2000).

Application of modern information technology in statistical work

In terms of workflow, the core of the statistical work can be divided into the data collection phase, the data processing phase, data distribution and data storage stage. At every stage, the application of modern information technology can improve work efficiency greatly. Currently, online reporting system, handheld mobile electronic mining price systems, remote sensing technology, geographic information systems, satellite positioning systems and other technologies have been applied to collect and process data, cloud computing, a national statistical database and other new technologies have been used to integrate lots of core business, etc. (Ms. Shi Fangchuan, 2000).

Information technology and data collection

Data collection is the cornerstone of a successful official statistics office. It is critical that data be collected correctly at the source. Increasingly administrative records are used instead of or to supplement surveys and censuses.

Administrative records have their own unique challenges in order that they are accurate and reliable. Source errors from surveys are difficult if not nearly impossible to correct even with the use of advanced statistical methods.

Traditionally, and still in widespread use today, paper methods were the most popular mode for data collection activities. Increasingly, telephonic, computer assisted and web-based modes are used. In addition to increased accuracy, these modes provide for better editing and validation procedures at the point of data collection. Today it is not usually necessary for an office to develop its own software applications in this field since off the shelf software is available.

Even with the most rigorous of data collection methods, editing and/or imputation procedures will sometimes be necessary. With respect to the ICT tools necessary for data editing and imputation, statistical offices can often look to software packages that have already been developed.

The management of data through the use of off-the-shelf data base management packages has become common in official statistics. These packages range from expensive, extremely sophisticated packages requiring substantial IT resources to relatively simple ones which operate on almost any PC.

Almost all database management packages include the ability to develop standard definitions for data and information and the relations between data items, hardware to house the data, including internal and removable storage, the software to edit, check for errors,

provide for access and set access controls, provide for security, implement data archiving policies, and in all ways manage the database.

It is critical that statistical offices understand the limitations and problems with their data. One way is for the statistical office to analyze its data. This analysis should help the office understand potential quality problems such as inconsistent and inaccurate data. Many off the shelf software tools are available to help in this analysis as well as in the production of data products. Software is available to process the data and to produce statistical information.

The credibility of statistical agencies rests on keeping the promise of confidentiality. If a breach occurs at an agency, even if this breach does not involve confidential information, the mere existence of the breach may damage the credibility of that agency.

It is arguable that it is in the area of data dissemination that IT has the greatest impact in recent years. It is not many years ago that users were content with paper based reports and tables from statistical offices. Now they demand not only internet based dissemination products but want to bypass traditional hierarchical tables for visualization and other user friendly techniques.

2. GENERIC STATISTICAL BUSINESS PROCESS MODEL

Specifying needs

If we take an example of any statistical survey, it responds to a concrete demand for statistical information. Therefore, at the beginning of the survey cycle, we have to specify the needs. At this stage that we will mainly communicate with the potential users of the data, usually those who initiated the task.

Initially, the standard business and communication software would be sufficient in this phase, in particular, in determining the needs for information, consultations with the users and defining the output. However, we will need an access to the existing database(s), in order to check data availability. We can again rely on the standard office software in preparing the business case (Juraj Riecan, 2013).

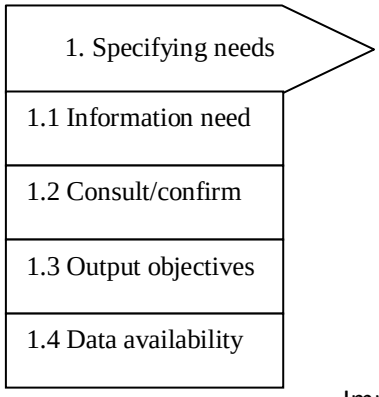

Figure 1

Design

This is the phase, when statisticians begin their own work on the future survey, census or other activity. Based on the results of the first phase, it means the specification of the needs, it is necessary to specify outputs, possibly using software for generating statistical tables.

At this stage specific statistical tools like Survey Processor (Croatia), Questionnaire designer (Australia), Blaise (Netherlands), etc. are used to perform specific design tasks including sampling design, metadata for variables, data collection (questionnaire, registers, etc.) design, choice of data processing methodology and workflow design.

The design phase is the first step towards formalising the requirements. Usually, it is possible to achieve the formalization sufficient from the statistical and IT viewpoint rather easily. In case of more complex design it is possible to use a modelling approach lithe UML (Unified Modelling Language) that is supported by commercial software like Rational Rose, etc (Juraj Riecan, 2013).

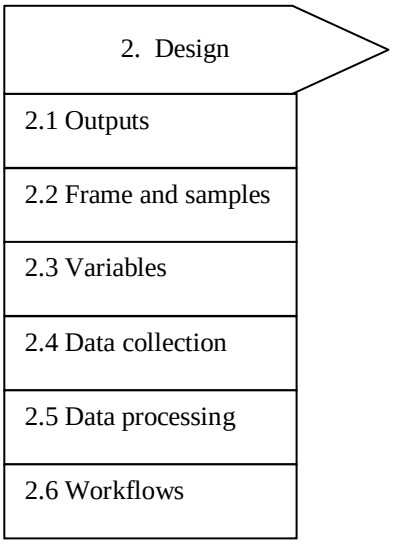

Figure 2

Build

The extensive use of the information technology in the statistical business process cycle requires an attention to the information systems and their components. This should be completed well in an early stage of the cycle, and a due attention should be paid to the testing. This will ensure that the actual statistical activity will be smooth, and there will be not delays due to technological issues.

A particular focus is on building and tailoring the tools that are used in the data collection and the data processing phases. The configuration of the tools will have to take into account specifics of the statistical subject matter treated. Therefore, it is important to have a clear data model. The data model comprises details of the multidimensional structure of variables and indicators, metadata, code lists, relationships between these components, etc.

Another aspect, when building the information system components, is to look not only in the current survey, but consider, at the same time, the reusability of components for other surveys. Vice versa, we may not need to build all components from the beginning, because they may already exist. In simple words, it is preferable to have in mind consistent information architecture of the statistical office rather than taking adhoc solutions. While the latter may give faster results from the immediate perspective, consistent information architecture will pay back in the long term.

So the components that will be built and/or configured in this phase include the data collection instruments and process components. These will be used immediately at the beginning of the survey. Further, we will configure the workflows (between components, units, etc.), and test all components and workflows so as to avoid unpleasant surprises during the survey itself. After the production systems are finalised the core statistical operation (survey, census, etc.) may begin.

Individual tasks in this stage may be supported by the software produced by some statistical offices, for example Blaise (Netherlands), SIV (Sweden), Quat (Netherlands), Questionnaire Development Tool (Australia) and VVIS (Estonia) (Juraj Riecan, 2013).

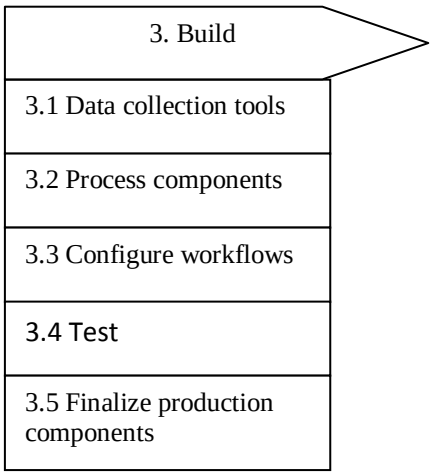

Figure 3

Collect

The data collection tools, built in the previous phase, will depend on the sources of data. In case of the classical survey and/or census, when we use traditional printed questionnaires, these may include software for a manual data entry or for an optical character recognition.

In case of data from administrative registers and records, we need either an off-line module for import and pre-processing of administrative data or a link to the administrative source itself. In either case, if we use administrative registers, it is advisable that the statistical office maintains a statistical register based on the administrative data. It means that the data collection consists primarily on the update of the statistical register, rather than on a full acquisition of all data. The two best known examples are statistical business registers (combining data from the commercial registers, licensing of small enterprises and individual entrepreneurs, etc.), or a statistical population register (updated from the population registers of the Ministry of Interior, but also from population censuses and municipal records), etc.

There are statistical fields that benefit from advanced technologies. For example the statistics on environment may use automatic registration of environmental variables at designated points of measurement (population, climate, etc.). The statistics on land use is a potential field of application of remote sensing tools – for example the satellite imagery.

So when we select a sample (when applicable), set-up a collection and run a collection, we ideally end up by having the data loaded into the production system. However, we should look into the quality of data and perform at least basic data checks already at the data collection phase. The data checks may be built into the manual data entry software that would flag suspicious record. When we use scanning and optical character recognition (OCR), we have to check first the quality of scanning and data recognition, and subsequently proceed with the basic statistical checks for outliers or otherwise suspicious data.

A specific case is the data collection via internet, when respondents themselves enter data into electronic on-line questionnaires. The questionnaire forms need to be equipped with the basic consistency checks that would flag the suspicious data and would prevent the respondent from proceeding further. In this respect let's stress that the built-in checks in on-line questionnaires should not appear abusive. We should focus only on the most important checks. If we would check for minor discrepancies, we may consider it legitimate from the data quality viewpoint, but the respondent may be discouraged, abandon the questionnaire, we would en-up with a non-response. In conclusion, the computer assisted checks in the data collection phase are

important, but on the other had there is a trade off between the data quality and the risk of nonresponse.

The sampling is supported for example by the following tools developed by statistical offices EHE Sampling (Norway), Generalised sampling System (Canada), MAUSS-R (Italy) and Survey Processor (Croatia). The data collection setup and execution are supported by VVIS (Estonia), Blaise (Netherlands), Quat (Netherlands), SIV (Sweden) and xcola (Finland). The Dutch Blaise system also supports loading of data into processing environment.

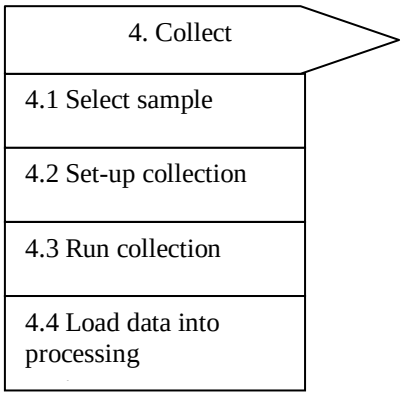

Figure 4

Process

This phase combines a large number of tasks that are aimed at protecting the confidentiality, ensuring quality, integrating data with data already existing in databases and performing all necessary calculations and estimations. There, therefore, an important complexity of IT tools that are used in this phase. We may combine the existing statistical packages like SAS and SPSS with specific modules prepared by statistical offices (see examples bellow). In all cases it is important to use an integrated data repository and an integrated metadata system, and provide for linking and data sharing between all tools employed in this phase.

The tasks listed in the Generic Statistical Business Process model are all possible tasks. A particular survey or census may not need to perform all of them at this stage. Let's begin with standardising and anonymizing the data. This may be facilitated already in the previous phase, depending on the design and method of data collection. If data were collected exclusively for statistical purposes, we may not need to focus too much on standardising, unlike if the data are collected from administrative sources.

As far as anonymizing is concerned, a simple removal of direct identifiers may not be sufficient. In order to prevent potential intruders would from obtaining confidential private information, software tools for avoidance of statistical matching are available – usually produced by national statistical offices.

With respect to the coherence of statistical information system the calculations and estimations should not take place off-line on a desk top of expert statisticians. These should be supported by the system. It is also important to integrate all data into a database, so that we have a record of the raw data, all intermediary aggregates as well as the final aggregates and estimators. The integration of data also implies the integration of underlying metadata, coding and classifying.

We have mentioned that basic checks already at the data collection phase. These allowed us to get back to the respondent in order to verify suspicious and/or missing data. At the data processing phase we may employ data editing and imputation tools that are more profound. These would allow us to go perform more in-depth evaluation of data quality. Unlike in the data collection phase, we would not go back to the respondent, but rather replace outliers and missing data with estimates. Two aspects should be kept in mind when using the editing and imputation tools. We should not use them abusively, the data should remain natural. Overdoing editing and imputation would lead to a risk of creating a synthetic data set away from reality. Another aspect is that the errors and edits should be fully recorded, and we should analyse them for systematic errors. The goal is to make adjustments to the design of data collection and avoid the same systematic errors in the next instance of the survey. We will come back to this at the evaluation stage of the cycle.

Finally we perform calculations and estimates needed for our outputs, that is deriving new variables, calculating weights and aggregates.
The standardisation and integration are supported by G-link (Canada) and RELAIS (Italy). The classification and coding process is supported by a range of software available at national statistical offices, like ABS Autocoder (Australia), Codificator automatic (Spain), G-Code (Canada), Postcode register (Netherlands), Sicore (France), VVIS (Estonia) and Blaise (Netherllands).

There is a whole variety of tools for statistical data editing. These are intended for specific editing and imputation approaches, some at the macroediting stage, some for editing microdata. More universal tools are Blaise (Netherlands) and Survey Processor (Croatia). More specific tools for data editing and imputation are Banff (Canada), CanCEIS (Canada), CONCORDJAVA (Italy), DIA V3 (Spain), ISEE (Norway), IST (Serbia), LogiPlus (Canada) and SELEKT (Sweden).

For calculating the weights and aggregates the Dutch VHM (Vullen Reference Database) may be considered along with the generalised Estimation System (Canada),

Price Index Processor System (UN Economic Commission for Europe), Price System Implementation Project (Australia) and StatMx (Canada).

Other software tools that may be considered at this stage, and that were produced by national statistical offices are DIGROS (Netherlands) AND Re-GENESEES (Italy).

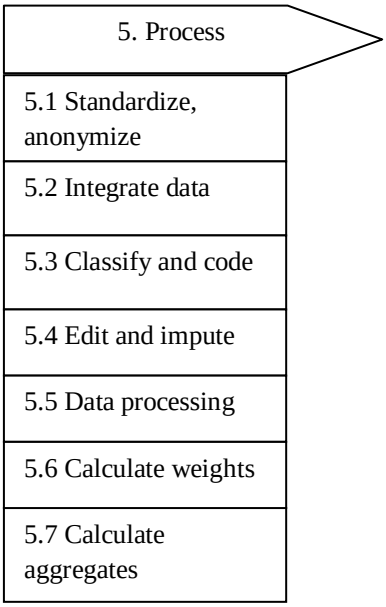

Figure 5

Analyse

This phase aims at creating desired outputs from the collected and processed data. Again we shall use statistical data analysis tools mentioned above. The set-up of the technology should take into account that this phase is performed by the statistical experts from individual subject matter domains. Not only that we should have in mind user friendliness, as they are more skilled in statistics than in IT. We should also reflect their substantive knowledge into the design of the IT tools.

Again we main need a variety of standard and tailored statistical packages that we have to integrate into a coherent statistical information system. These will help us to perform statistical analysis and prepare draft outputs. We may need tools for verification of outputs (for example checking whether all assumptions were satisfied for employing the methods employed).

Interpreting and explaining the results is based on the personal expertise of statistical experts. However, they should have access to the metadata system and record their findings, so that these can be used when disseminating and communicating data to the users.

Before the final aggregated data and results of analysis may be presented to users, we should ensure that the private and confidential information is protected. Appropriate tool for data disclosure control help us to make sure that neither direct identification nor statistical matching can be used to obtain confidential information.

Once the subject matter specialists finalize the outputs for dissemination, these can be passed on to specialists in dissemination and communication.

Statisticians may again use either the marketed IT tools like SPSS and SAS or tools developed by statistical offices: Demetra+ (Eurostat), G-Series, G-Tab and Price System Implementation System (Canada), PX-Edit (Sweden) and Re-GENESEES (Italy).

The quality control is supported by Stat Control (Netherlands) and EVER (Italy). The disclosure control is a specific task. Specialised software suitable for official statistics was developed by Statistics Netherlands under the name of Mu-Argus and Tau-Argus. Other disclosure control tools are Confid2 (Canada) and Rounding (Norway).

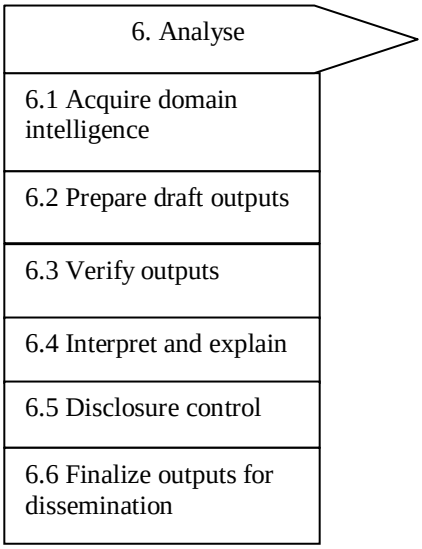

Figure 6

Disseminate

The statistics is meaningful only when it reaches the user. Official statisticians think usually about the statutory users, who already expect the data to be presented to them. However, we should not omit the public, media, researchers, etc. Therefore, this phase includes also an outreach to new users through marketing and maintaining public relations. This phase has a potential to use already existing IT tools for publishing – whether printed or electronic, and in particular over the internet. However, there is still a need for specific tools enabled with statistical

capabilities. Some of these may be the ESCWA Statistical Information System (ESIS), PC-AXIS produced by a consortium of about 30 statistical organizations around the World led by Statistics Sweden, DevInfo offered by UNICEF, OECD.net that is available from the Organizations for Economic Cooperation and development, etc. We may need to add to these GIS tools for cartographical interpretation of data, for example Mapresso, produced by the University of Zurich.

Other tools for data dissemination are SDMX tools (a consortium of international organizations), StatFlow and StatWeb (Netherlands), CoSSI (Finland), ISTAR (Italy), Business Tool Box (New Zealand), Jaxi (Spain) and REEM (Australia).

When we talk about electronic on-line dissemination, the data are normally continuously available on the internet. In that case we update the existing outputs rather than create new ones. However, we may also produce print or electronic products (CD-ROMs, etc.). Depending on the culture of the statistical system the office may have to respect a strict release calendar. Therefore, some statistical offices developed specific tools for managing the data releases.

We may use standardised IT tools available on the market for marketing and for managing customer queries. The latter can be supported by tools usually used by call centres and helpdesk for managing requests (Juraj Riecan, 2013).

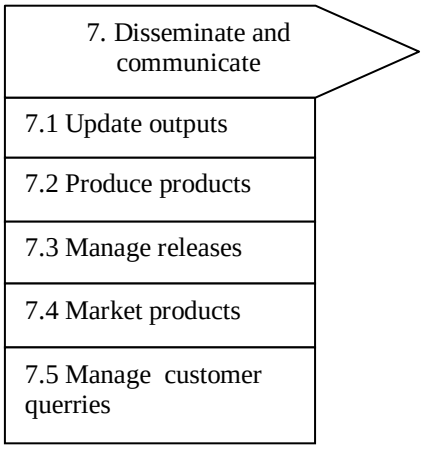

Figure 7

Archive

Once the dissemination is completed, the core tasks seem to be over. However, taking into account the periodic character of statistical surveys, it is important to archive the information for the future round and for the institutional memory, and to feed the lessons learned to the future rounds of the survey. The archiving phase is typically supported by the traditional database management software. The records stored in the archives should be managed also by a set of rules, preferably automated. The rules primarily refer to the retention, safeguarding and access. It is important to highlight that the archived statistical information may still carry some confidential elements, and the access rules should preserve these similarly as for the "live" data.

Once the rules are defined, the archiving module of the statistical information system should manage the repository, preserve data along with all associated metadata and manage also disposal of records that are beyond the specified retention period (Juraj Riecan, 2013).

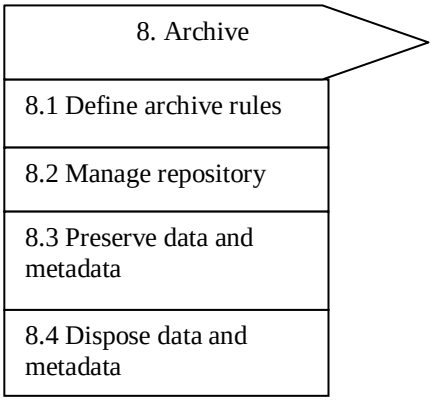

Figure 8

Evaluate

As mentioned above, the statistical surveys are generally periodic. However, it is important to ensure that the issues and problems tackled in the present round of the surveys do not repeat again. Therefore, in the processing phase we mentioned that all edited outliers and missing data should be recorded. These records should be then carefully analysed for a pattern of systematic errors. This is essential for ensuring data quality, because it is not meaningful to continue editing and imputation with respect to the same systematic errors in the future rounds of the survey.

Similarly as for the initial phase, we will mostly use the standard office and communication software. The evaluation phase concludes our journey through the Generic Statistical Business Process Model.

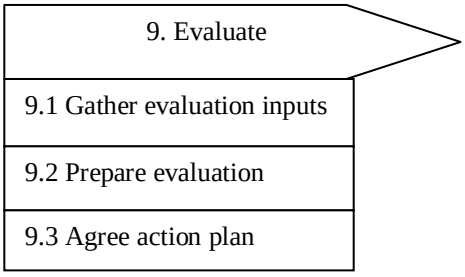

Figure 9

3. MANAGERIAL ISSUES OF INFORMATION TECHNOLOGY IN STATISTICAL DEVELOPMENT

Over the years, agencies and processes for producing, using and maintaining statistics as a basis for evidence-based policy making and monitoring were severely eroded, and increasingly, policy making in Nigeria became ad hoc, and monitoring of policy outcome completely absent. Demand within government for good statistics, especially during decades of military rule, declined precipitously; so too did funding for the development of statistical capacity and infrastructure, statistical production and maintenance. There has been a rapid increase in demand for statistics since the return to democratic governance in the country to better support national development processes. This demand has brought to bare (a) the weaknesses in statistical capacity and the dearth of data on social and economic indicators required for monitoring achievement of results on development policies and initiatives, (b) the unreliability of existing data, and (c) unsustainability of current statistical activities (Statistical Master Plan for the Nigeria National Statistical System, 2004/5-2008/9).

The weaknesses inhibiting performance of the National Statistical System were identified as lack of a statistical culture, inadequate statistical advocacy, outdated and rather limiting 1957 Statistics Act, overlapping roles among agencies, insufficient coordination and feedback mechanisms, lack of clarify of statistical function in some line ministries, under-resourcing of statistical agencies and activities, general poor IT application among many agencies, inadequate knowledge management, poor maintenance of equipment, inadequate data management and dissemination, lack of data at low levels of aggregation and lack of timeliness in data release. Serious data gaps on many areas of national development were identified including poverty, gender, environment, food security, governance, etc (Statistical Master Plan for the Nigeria National Statistical System, 2004/5-2008/9).

Why is management of technological change in statistics so difficult?

Management of information technology in a statistical institution is a difficult and large challenge because:

- Technology is new, and develops rapidly.
- Technological experts tend to put ambitions too high.
- New technology implies and is dependent on new organisation of work processes.
- Organisation of technology is difficult, and poorly defined responsibilities and links to top management may be a problem.
- Problems are often met with more resources; it is hard to admit that lack of IT experience may be the issue.

Development in and with the help of information technology normally requires extra input from experienced personnel. However, the tasks of a national statistical institution require continuous production. This makes it necessary to have increased resources for the development period, and costs will be higher in the short run even if the goal is increased efficiency in the long run. This is illustrated in figure 1, and contributes to explain why development and change of technology is a difficult and time consuming process. Sometimes the introduction of new technology implies increased production and quality, and in this case the curve in the figure may not fall after the transition period at all (Hans Viggo, 1997).

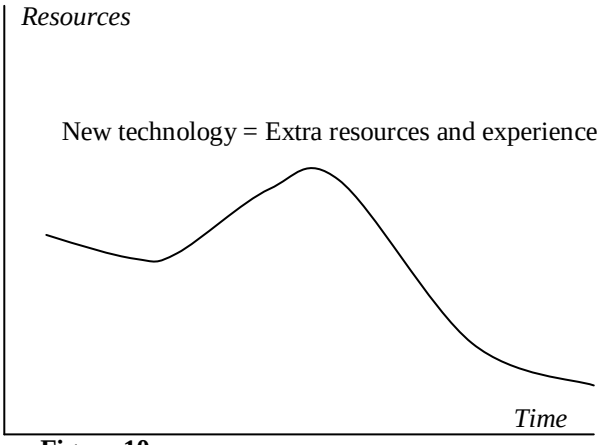

Figure 10

Dependence on technological experts

Technological expertise is a precondition for development and migration of new and complicated technology in statistical institution, but the dependence on such expertise also represents a problem to management. Managers cannot themselves have the necessary insight in every technical question, and the use of internal and external advisers is crucial. Most statistical institutions has a decentralised organisation, and this makes it difficult to obtain unambiguous advice. Technological experts tend to agree on putting ambitions high, but at the same time they almost notoriously tend to disagree on specific choices of hardware, software and methodology. On several occasions reluctance from management and the rest of the organisation has saved us from wasting money and manpower, but this may of course also prevent important decisions to be taken and slow down necessary changes (Hans Viggo, 1997).

Diverging opinions in the organisation require clear decisions by top management, and when the decision has been taken, it must be followed by information and necessary resources.

Organisation

A decentralised organisation makes it easier for staff to identify with the statistical products, and promotes co-operation in projects which can be limited to one statistical subject matter area. A decentralised organisation of IT experts is also an advantage for their participation in such projects. However, questions of technological infrastructure (not only hardware such as computers and networks) cannot be successfully solved without a close co-operation between experts throughout the whole organisation. In many cases the organisation as such will be better off with solutions that for some projects may be considered suboptimal. Hence, IT requires strong co-ordination, and this is of course a larger challenge in a decentralised organisation than in a centralised one. Another argument for strong co-ordination is the dependence on specialists which constitutes a scarce resource in most statistical institutions (Hans Viggo, 1997).

Choice of technology

It may be risky to choose the most recent version of technology if this is not well tried. A statistical institution is different from most other institutions, and in many respects it is more relevant to go abroad and compare ourselves with other statistical institutions than with other national institutions. Typical and often unique functions of a statistical institutions are processing of large amounts of data resulting from the linkage of several administrative registers, use of statistical standards and production of statistical tables. In all these cases we have experienced difficulties linked to change of technology (Hans Viggo, 1997).

On the other hand technology and especially software should be purchased and not developed within the institution if convenient systems are available. Open systems that communicate with each other and on which it is easy to get support in the market might be preferred to more specialised systems even if the latter are regarded as better. There is a tendency in most technological environments to develop solutions themselves, which is natural since self-developed software more easily will fulfil the specifications, and development is more interesting than shopping. However, in addition to be expensive (when working hours are taken into account), self-developed software is vulnerable since it might be dependent on support from one or a few persons (Hans Viggo, 1997).

Integration of IT in statistical work

Use of PCs and software for office support have made IT to an important part of every employees work. In particular young statisticians, economists and other professionals are often well experienced in use of IT. However, there are some employees who still regard Electronic Data Processing (EDP) in general as something for IT specialists. It is important that simple tasks such as data extraction, transfer and analysis (including construction of statistical tables) are carried out by the people being responsible for the statistical products. Experienced IT-personnel are in short supply, and should be able to concentrate on support, systems development or adaptation and more strategic tasks (Hans Viggo, 1997).

Human resources

Principles and plans for management and use of IT may be good, but we will attain little if we do not have good human resources, even if external consultants are used in an optimal way. The labour market for IT specialists has varied over the years. For the time being, we have severe difficulties in keeping people with knowledge and experiences in new technology more than 1-2 years in statistical institutions. It is a paradox that if we do things well and successful projects are exposed to the professional society outside statistical institutions, the probability of loosing key personnel increases.

The question of human resources is therefore a major concern to management in this area. In Nigeria, Governmental organisations in general cannot compete with private businesses or research institutions on salaries. Hence other factors like interesting and challenging tasks, good working environment, possibilities for training and personal development must be emphasised. IT itself has enabled more flexible working conditions, and we have recently seen a tendency that companies with highly educated personnel such as consultancy companies have started to take advantage of this by for example including work at home in working hours. For large national statistical institutions with many types of employees this represents a challenge, and necessitates increased flexibility (Hans Viggo, 1997).

Major obstacles in the use of IT for statistical development

1. To introduce effective and efficient technologies and techniques in every stage of statistical data processing through the whole statistical system.
2. There is a big gap between techniques and equipment levels in central and regional statistical offices.
3. Shortage of Government funding for purchase of IT equipments and its up to date upgrades.
4. Insufficient Government funding for Operation system and statistical software packages and its licenses.
5. Lack of staff knowledge and skill for using technological progresses at the low level administrative unit and could not provide regular and integrated training system to provide principle as statistical data should be reliable.
6. Lack of certified professionals in IT.
7. More capacity building trainings for IT professionals to create an integrated statistical database and provide statistics to users by online service.
8. IT personnel training on networking, data management and software development.

4. A WAY FORWARD

It is important to facilitate the exchange of expertise and experience related to the role of IT in official statistics and other issues related to the statistical infrastructure. The statistical offices in developed nations have each some experience that may be important to other statistical institutions in developing countries like Nigeria. The issues of interest for this institutions may be the following:

(a) Statistical information systems and IT tools in support to official statistics;
(b) Sharing the development of IT tools and components of statistical information systems between statistical offices;
(c) Statistical metadata;
(d) Statistical quality control, including methods and techniques for editing and imputation;
(e) Use of administrative registers and records, linking of registers and maintenance of statistical registers, including statistical business registers, statistical population registers and others;
(f) Protection of confidentiality of statistical data and control of disclosure risks;
(g) Issues related to the use of geographical and cartographical tools in support of official statistics.
(h) Advanced methods for dissemination and communication of statistics and relationship with users.

5. CONCLUSIONS

Information technology is the backbone of the activity of a national statistical institute today, but managing it is difficult due to several reasons of which rapid changes, the dependence of specialists and organisational issues are important. In Nigeria statistical development, we have had both successes and failures in this field, and it is a general experience that technological changes require more time and resources than foreseen. We are still facing many problems and challenges in this field, but some conclusions can nevertheless be drawn as for the management of IT:

• Ambitions should not be put too high.
• Decisions on technological change must be made clear by top management, and followed by information and necessary resources for the implementation.
• Strong co-ordination, well-functioning co-ordinating bodies and project organisation across a decentralised organisation is necessary.
• New technology implemented and applied should have been tried out in other institutions first.
• Some use of external consultants is convenient, but this requires corresponding internal resources to ensure follow-up of results.
• The issue of human resources is crucial, and consolidation of staff and experience calls for flexibility.

REFERENCES

[1] Gerelt-Od G. (2007). Managing Statistical Development and Information Technology for Statistical System of Mongolia.
[2] Hans Viggo (1997). Managerial Issues of Information Technology in Statistics Norway.
[3] Juraj Riecan (2013). Role of the information technology in official statistics
[4] Sefiu Taiwo Oloruntoyin and Ibrahim Adepoju Adeyanju (2013). The Role and Prospect of Information and Communication Technology in National Development. *International Journal of Computing Academic Research (IJCAR), Volume 2, Number 3 (June 2013), pp. 113-119*
[5] Shi Fangchuan Ms. (2000). The Application of Modern Information Technology on Official Statistics in China.
[6] Statistical Master Plan for the Nigeria National Statistical System (2004/5-2008/9)