

Professional Practices Group

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To

All Heads of Field Offices

Practitioner's Guide for use of Data Visualisation and Infographics

1. Objective of the Guide

This document aims to provide guidance on use of data visualisation or infographics to represent data and information for enhancing the quality of reporting and presenting in various documents prepared in the Indian Audit & Accounts Department.

The terms “Data visualisation” and “infographics” are used synonymously and interchangeably to describe the presentation of data or information through graphics or visual means. Infographics have an intrinsic feature of emphatically communicating complex relationships between various sets of data and information, which can be leveraged while reporting so that Audit Reports and other audit and account products become lucid, more understandable to a wider range of stakeholders while not compromising on depth of analysis. While infographics are a very good media for effective communication and have significant advantages, their incorrect usage could lead to misrepresentation of information leading the reader to draw wrong and unintended conclusions.

This guide discusses the characteristics of data visualisation/ infographics and enunciates the principles for usage of appropriate techniques in various documents prepared by the Department. This in no case means a complete substitution or replacement of text with graphs and diagrams. Effective reporting would involve a judicious mix of text, tables, graphs and charts and other diagrams in relation to the subject matter being reported upon and infographics are intended to complement the textual content. Professional judgement should be exercised while opting for the prudent combination of infographics.

This guide carries examples which are directly applicable to reporting of audit results, however, the principles apply equally to accounts presentation.

2. Essentials of Reporting

On completion of each audit assignment, the auditor should prepare a written report setting out the audit observations and conclusions in an appropriate form; its content should be easy to understand, free from ambiguity and supported by sufficient, competent and relevant audit evidence and be independent, objective, fair, complete, accurate, constructive and concise' **(Para no 7.1 of Performance Auditing Guidelines).**

Auditors should prepare a report based on the principles of completeness, objectivity, timeliness and contradictory process. **(Para no 2.19 of Compliance Auditing Guidelines).**

Significant irregularities noticed during audit of finance accounts and appropriation accounts should be presented as audit findings along with an analysis of underlying causes and their impact. **(Para 4.15 of Financial Attest Auditing Guidelines for audit of State Government Accounts)**

3. Data visualisation in Reporting

Data visualisation plays a crucial role in aiding objective, complete, concise and constructive reporting as visual techniques very effectively convey intricate patterns, trends, correlations between variables in the information in a manner that enhances the comprehension of the intended users. It promotes better appreciation of the audit findings and conclusions and addresses the growing needs and expectations of a wider range of interested stakeholders. It can also assist in presenting financial and accounting information in a more comprehensible fashion.

Easy to use tools and applications for data visualising and preparing infographics are available that can enhance the accountant's and auditor's access and ability to leverage visual techniques for analytics and reporting. The three basic elements for data visualisation are:

- objects (the data points)
- values (also called attributes) and;
- relations

Objectives of Data Visualisation

Data visualisation aim at achieving one or more of the following objectives:

- **Comprehensibility:** makes information and relationships easily understandable
- **Comprehensiveness:** presents features/information for the entire selected data set/sample size as against selective reporting
- **Focussed communication:** facilitates concise and 'to the point' communication
- **Reducing complexity:** simplifying the presentation of large amounts of data

- **Establishing patterns and relationships:** enables identification of patterns and relationships in the data
- **Analysis:** promotes thinking on 'substance' rather than on 'methodology', It focusses on the essence of the finding being communicated rather than on the procedure for communication.

4. Principles for using data visualisation

The principles that should be followed while using data visualisation are as under:

a) **Relevance - Must fit to purpose**

The first principle of any visual representation, be it graphs, charts, maps, organograms, process flow diagrams or even pictures, is that it **MUST** confirm to the purpose for which it is being used. In the context of audit reports it means the visual presentations should confirm or contribute to concluding against at least one of the objectives. In case of presenting financial information in case of accounts, it should relate to the theme under discussion or analysis. The visual matter, therefore, must portray a broad theme being pursued and ideally should not contain more than two sub themes.

b) **Functionality - Must help enhance content**

Even while the representation through visual means fit one or more of the objectives its utility must be further tested to assess whether it enhances the readability or content of the report. Visual representation should not be a means to merely demonstrate the facts/components of the subject matter but should aim to throw up the audit finding or the cause effect relationship of the sets of data. If an explicit message is not emerging from the infographic, a table would probably suffice to present the data.

c) **Simplicity and User friendliness - Must be designed keeping the reader in view**

The infographic needs to be designed in a manner that is self-explanatory so that the reader does not have to read the main text to understand them. The design should be simple, allowing the reader to view the numbers, trends and relationships of the data by minimising embellishments on tables and graphs.

The **title and labels** of the infographic should be concise and the visualisation should be organised in a manner that the point is obvious. The title should reinforce the message of the infographic.

The infographic **should not be over-complicated** by attempting to show two or more disparate sets of information. Additionally, distortions such as 3-dimensional graphics and unusual formats such as spider graph, cluttered backgrounds, gridlines, multiple fonts, borders, bold and underlines need to be avoided as they distract the user from the infographic's message.

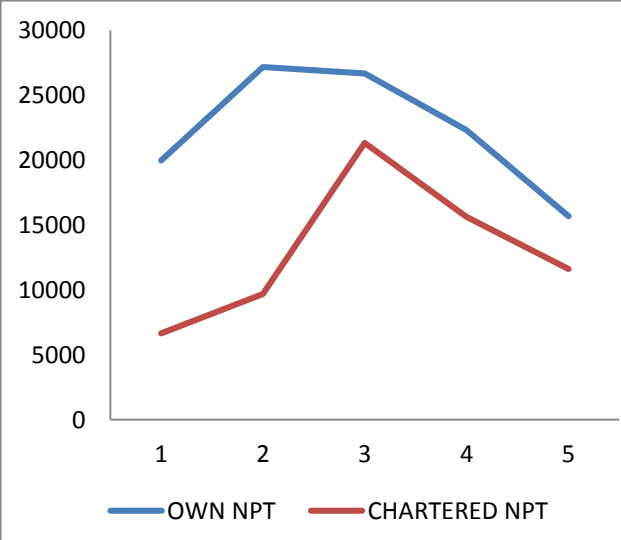
d) Must balance 'form' and 'function'

An ideal infographic should clearly communicate information as well as stimulate the engagement and attention of the user. Therefore usage of infographs should seek to achieve a judicious balance between form and functionality. Elegance and sophistications in infographics are as critical as the purpose and accurate presentation of information since they enhance the visual appeal of the infographs. Appropriate choice of infographs enriched by suitable colour combinations to depict varying range of performance/deficiencies supports easy comprehension of the intended message. The traffic signal solution may be used to portray ranges of performance - red colour to depict poor performance, amber/yellow to indicate average performance and green to describe good/very good performance.

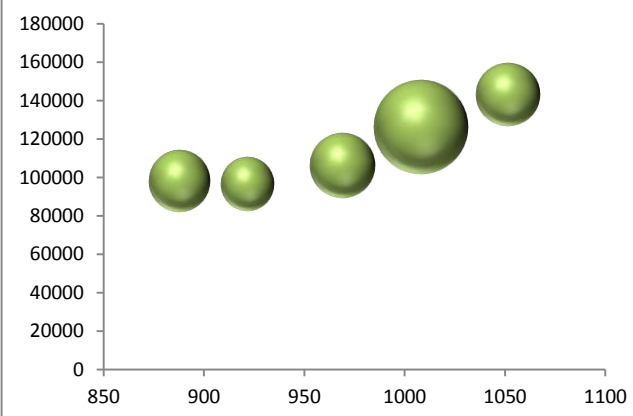
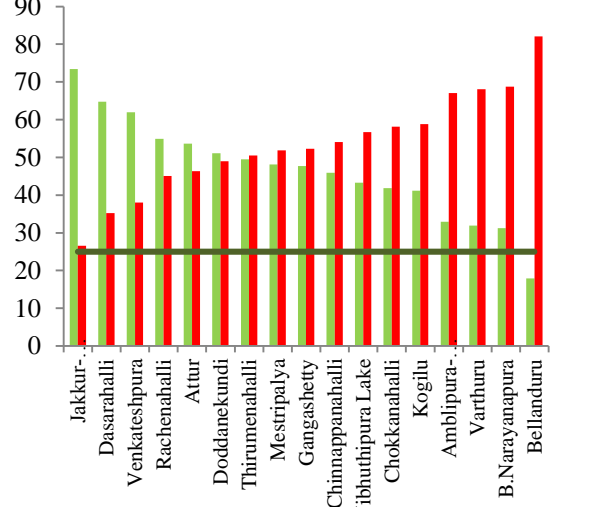
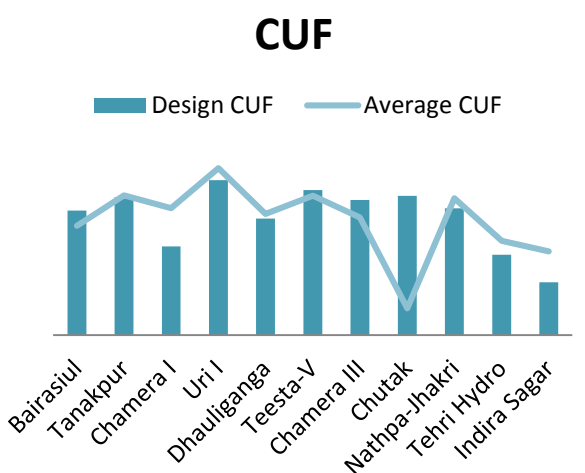
5. Guidance on the Choice of Infographic

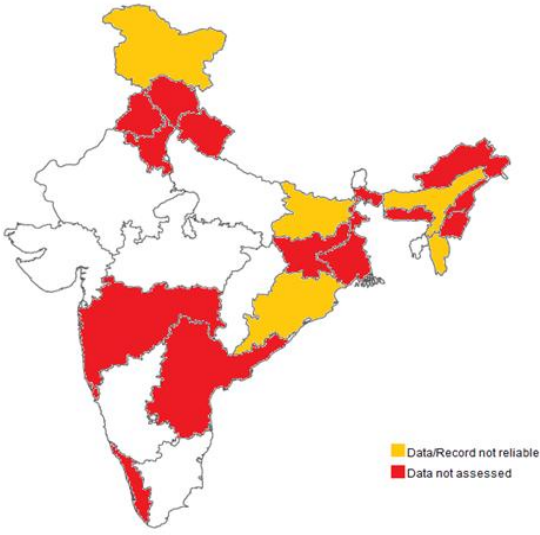
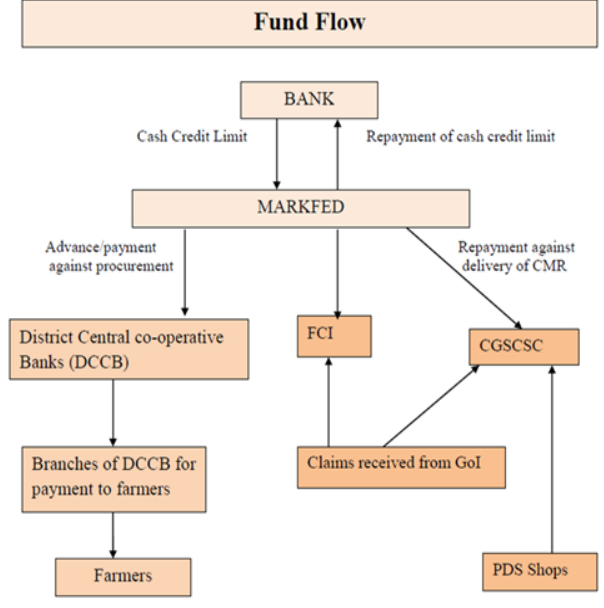
There are numerous types of infographics to present trends and relationships, such as changes over time, correlations, and frequency distributions and their usage depends upon the context and the subject matter that is being reviewed and presented in reports. While all audit situations cannot be perceived, it is possible to lay down broad generalisations of the types of infographs, based on their attributes to best address the situations commonly encountered by auditors.

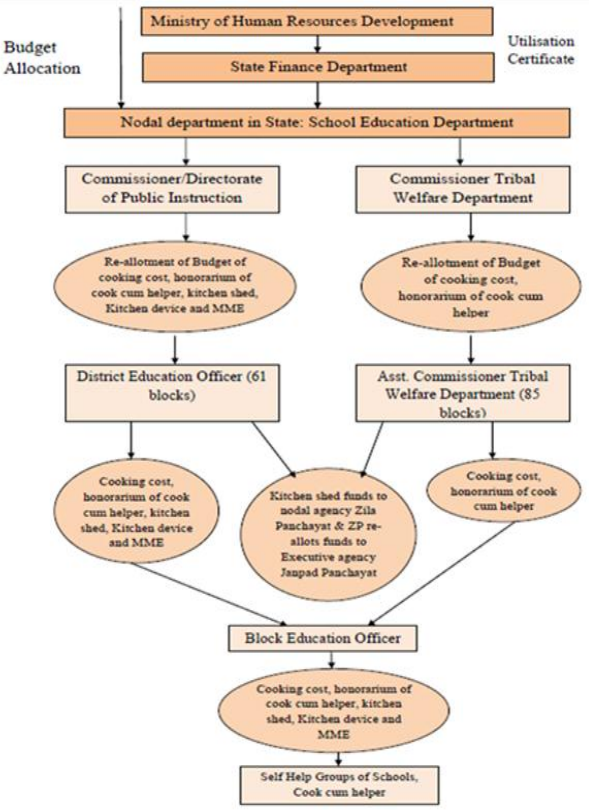
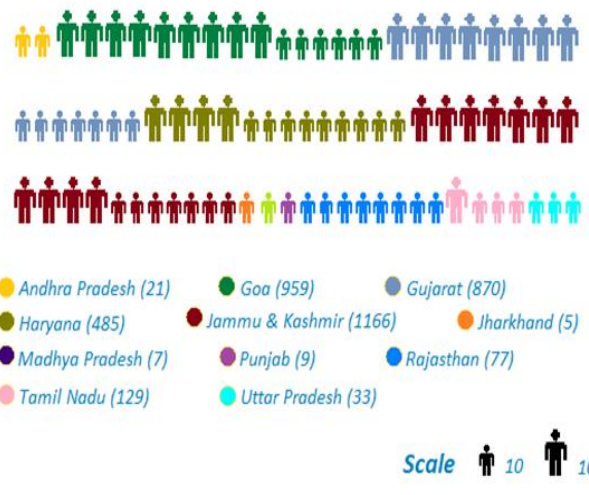
The following table provides an illustrative set of infographs that can aid us in opting for appropriate infographs, which can be used in Audit Reports, financial reports and other products with suitable modifications to address specific situations and contexts.

Type of visualisation/ infographic	Situation	Illustration																		
Line graphs	Line graphs are useful for emphasizing the movement or trend of numerical data over time. Highs and lows, rapid or slow movement, or a tendency towards stability are all types of trends that are well suited to a line graph. Line graphs can also be plotted with two or more scales to suggest a comparison of the same value, or set of values, in different time periods.	 <table border="1"><thead><tr><th>Period</th><th>OWN NPT</th><th>CHARTERED NPT</th></tr></thead><tbody><tr><td>1</td><td>20000</td><td>7000</td></tr><tr><td>2</td><td>27000</td><td>10000</td></tr><tr><td>3</td><td>26500</td><td>21000</td></tr><tr><td>4</td><td>22000</td><td>15000</td></tr><tr><td>5</td><td>15000</td><td>11000</td></tr></tbody></table>	Period	OWN NPT	CHARTERED NPT	1	20000	7000	2	27000	10000	3	26500	21000	4	22000	15000	5	15000	11000
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Bar graphs	<p>Bar graphs plot numerical data by displaying rectangular blocks against a scale. Viewers can develop a clear mental image of comparisons among data series by distinguishing the relative heights of the bars. A bar graph may be used to display numerical data to present distributions of data. Stacked bar graphs may be avoided since comprehension is difficult and when used to compare between two periods they tend to convey unintended inappropriate conclusions.</p>	<table border="1"><caption>TREND OF REVENUE</caption><thead><tr><th>Year</th><th>Tax Receipts - Budget Estimates</th><th>Tax Receipts - Actual collection</th><th>Total receipts of the State</th></tr></thead><tbody><tr><td>2008-09</td><td>10616.39</td><td>11377.13</td><td>15991.18</td></tr><tr><td>2009-10</td><td>12711.94</td><td>12770.89</td><td>17625.02</td></tr><tr><td>2010-11</td><td>15125.69</td><td>15815.11</td><td>21721.69</td></tr><tr><td>2011-12</td><td>19427.90</td><td>18918.83</td><td>25718.60</td></tr><tr><td>2012-13</td><td>23450.52</td><td>22511.69</td><td>30076.61</td></tr></tbody></table>	Year	Tax Receipts - Budget Estimates	Tax Receipts - Actual collection	Total receipts of the State	2008-09	10616.39	11377.13	15991.18	2009-10	12711.94	12770.89	17625.02	2010-11	15125.69	15815.11	21721.69	2011-12	19427.90	18918.83	25718.60	2012-13	23450.52	22511.69	30076.61						
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Pie graphs	<p>Pie graphs emphasize part-whole relationships of a single variable. Pie graphs work best when data consists of several large sets. Too many sets divide the pie into difficult to see. Color or texture may be used on individual segments to create visual contrast. The pie charts should not be used to compare between two periods unless the variation in the overall size of the pies (of the two periods) are also appropriately depicted.</p>	<table border="1"><caption>INVESTMENT IN COMPUTERISATION (Value ₹ in crore)</caption><thead><tr><th>Category</th><th>Value (₹ in crore)</th></tr></thead><tbody><tr><td>Software investment</td><td>5.9</td></tr><tr><td>Hardware investment</td><td>8.28</td></tr><tr><td>Network investment</td><td>6.57</td></tr><tr><td>Expenses for awareness programme</td><td>9</td></tr></tbody></table>	Category	Value (₹ in crore)	Software investment	5.9	Hardware investment	8.28	Network investment	6.57	Expenses for awareness programme	9																				
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Area graphs	<p>Area graphs are similar to line graphs except that the area between the data line and the zero line (or axis) is usually colored or textured. Area graphs allows stacking data on top of each other. Stacking enables highlighting the relationship between data series, showing how some data series approach or shadow a second series.</p>	<table border="1"><thead><tr><th>Year</th><th>Software investment</th><th>Hardware investment</th><th>Network investment</th><th>Expenses for awareness programme</th></tr></thead><tbody><tr><td>2009-10</td><td>40</td><td>15</td><td>25</td><td>20</td></tr><tr><td>2010-11</td><td>40</td><td>15</td><td>25</td><td>20</td></tr><tr><td>2011-12</td><td>40</td><td>15</td><td>25</td><td>20</td></tr><tr><td>2012-13</td><td>40</td><td>15</td><td>25</td><td>20</td></tr><tr><td>2013-14</td><td>40</td><td>15</td><td>25</td><td>20</td></tr></tbody></table>	Year	Software investment	Hardware investment	Network investment	Expenses for awareness programme	2009-10	40	15	25	20	2010-11	40	15	25	20	2011-12	40	15	25	20	2012-13	40	15	25	20	2013-14	40	15	25	20
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<p>Bubble charts</p>	<p>Bubble charts are used to display three variables requiring only three COLUMN field representing X, Y and Z data values in that order. The data points can be either opaque or transparent bubbles. The size of the bubbles are proportional to the values they represent.</p>	
<p>Combination of Bar and line diagram</p>	<p>A bar diagram can depict the variation in actual performance while the superimposed line diagram can be plotted to show the norm/yardstick.</p>	<div data-bbox="852 674 1487 1223">  </div> <div data-bbox="852 1245 1471 1760"> <p style="text-align: center;">CUF</p>  </div>

<p>Geographical Maps</p>	<p>Such maps highlight the geographical or spatial variations. Appropriate color choices could distinguish between the various levels of performance/coverage.</p>	
<p>Flow diagrams</p>	<p>Flow diagrams explain work flow in any system. Flow diagrams can be a mix of hierarchy and function. It helps in pinpointing accountability by highlighting actionable points. While drawing a flow chart, care should be taken to identify the crucial processes and the accountability centres so that audit can focus on these issues.</p>	

<p>Organisational charts /Function decision information flow diagram</p>	<p>The chart is meant to describe the hierarchical positions in the departments as well as the functional interconnectivity. The chart can be used to depict not only the functional hierarchy but also the flow of decisions and information in the system. Therefore instead of an organogram which is not very revealing, a “function-decision-information flow” diagram is a better alternative.</p>	 <pre> graph TD A[Ministry of Human Resource Development] --> B[State Finance Department] B --> C[Nodal department in State: School Education Department] C --> D[Commissioner/Directorate of Public Instruction] C --> E[Commissioner Tribal Welfare Department] D --> F([Re-allotment of Budget of cooking cost, honorarium of cook cum helper, kitchen shed, Kitchen device and MME]) E --> G([Re-allotment of Budget of cooking cost, honorarium of cook cum helper]) F --> H[District Education Officer (61 blocks)] G --> I[Asst. Commissioner Tribal Welfare Department (85 blocks)] H --> J([Cooking cost, honorarium of cook cum helper, kitchen shed, Kitchen device and MME]) I --> K([Cooking cost, honorarium of cook cum helper]) J --> L([Kitchen shed funds to nodal agency Zila Panchayat & ZP re-allots funds to Executive agency Jaspad Panchayat]) K --> L L --> M[Block Education Officer] M --> N([Cooking cost, honorarium of cook cum helper, kitchen shed, Kitchen device and MME]) N --> O[Self Help Groups of Schools, Cook cum helper] </pre>
<p>Pictorial representation</p>	<p>Useful while depicting beneficiary related situations of exclusion/ wrongful inclusion of beneficiaries.</p>	<p>Other Ineligible Beneficiaries</p>  <p> ● Andhra Pradesh (21) ● Goa (959) ● Gujarat (870) ● Haryana (485) ● Jammu & Kashmir (1166) ● Jharkhand (5) ● Madhya Pradesh (7) ● Punjab (9) ● Rajasthan (77) ● Tamil Nadu (129) ● Uttar Pradesh (33) </p> <p>Scale 10 100</p>
<p>Additional assistance on choosing the appropriate infographics and visulisation methods are available on the folowing web links:</p> <ul style="list-style-type: none"> • www.visual-literacy.org/periodic_table/periodic_table.html# • http://labs.juiceanalytics.com/chartchooser/index.html 		

6. Conclusion

Data visualisation therefore enhances the quality of reporting both in terms of the substance as also the form and promotes better understanding and appreciation of audit findings. The generic principles and illustrative usage have been set out in this practitioner's guide is intended to serve as a baseline guidance. Some practical illustrations have been tried out and these initial attempts of data visualisation, including interactive data visualisation have been demonstrated in the third and fourth editions of e-journal (Journal of Government Audit and Accounts) available on our website. The domain of data visualisation is, however, wide ranging and can be imaginatively exploited to suit diverse reporting and presentation contexts. Increased use of data visualisation is envisaged in our Department and field offices are therefore encouraged to leverage the full potential of data visualisation in Audit Reports, financial reports and other products. Field offices could also explore using interactive data visualisation while disseminating abridged versions of reports and products on the electronic media.

(Meenakshi Sharma)
Director General (PPG)

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