

A CARTOGRAPHIC MANAGING STANDARD TO CONTROL MAPPING PROJECTS

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Existing mapping projects comprise complicated processes requiring intensive management guidance. Particularly if digital technology is involved it is difficult to recognise which steps have to be followed if cartographic products are made. Managers need tools to control projects. Tools are available in the planning sphere, but planning requires more managing data such as steps and the number of steps in a process.

Mapping projects require structural plans for decisions when controlling on quality. Projects have to be cost calculated before, during and after production. Detailed data should support the manager and the executive operator on production time consumption. The paper which is presented offers fundamental tools for controlling projects. With the presentation the author intends to present a potential international standard as a guide for managers, cartographic operators, educators and students.

1 Introduction

It was at the ICA conference of Bournemouth that the idea was born that there should be a system for the control of cartographic digital map production flows other than the existing broad overview like appearing on computer hardware and mapping software selling brochures and booklets.

A very first attempt was made in 1992. A complete lacking of detailed production overview brought several people together and after extensive discussions the first flow diagrams for digital production were designed. However, lack of clarity of symbolisation and illegibility of the entire production flow diagram symbolised by the current symbols resulted in a somewhat negative approach towards the use of the actual flow diagram at that moment.

Since this was not the idea behind all this, the situation resulted in a new attempt for the creation of flow diagram symbols for cartographic production processes. This time the symbolisation for digital environment was based upon existing conventional mapping processes. The basics of both conventional and digital flow diagrams should have been the same. It was just the symbol shapes that were slightly but fundamentally different but these should have relationships. Therefore it was possible to symbolise a combination of conventional and digital actions of a production process in one system of flow diagram symbolisation.

After 2 years of testing the existing flow diagram symbolisation changes seemed to need alteration. The most important change had to be made with action items around the manipulation item. 'Manipulation' had given too much confusion in the explanation of what is actually the meaning of manipulation. The same appeared with editing and therefore the terms manipulation and editing had to be reconsidered. A second point of consideration was the freedom of use of locally created and applied symbols for an own production flow. Intensive but useful discussions have led to the solution of allowing minor individual changes in the infill of the so called action symbols.

At this moment we are at the point of the acceptance of a standard for cartographic mapping projects.

2 Existing situation

After all the tests and checks were done and after intensive external investigations to the use of the new symbolisation of flow diagrams a new classification of symbols was required due to the draft and not completed version for the first proposal of the relevant symbols and the evaluation requiring a more advanced edition.

A three months period of analyzing, reorientation and reclassification had been reserved for the research and had led to a complete new list in which all the symbols are displayed and where all the symbols are positioned in a logic and above all classified way.

For the traditional map making there was no need for any alteration of symbolisation, because there are hardly changes noticeable at this moment and for the future as well. This is of course due to the changing period which rapidly develops towards digital technology. For digital production a basic change was required and some minor items have been adjusted. It might be well possible that more changes have to be made but it will never give a major impact on the existing symbolisation.

The proposed symbols for digital productions have approximately remained the same.

The main change is the determination of the actions called 'editing' and 'manipulating'.

Since the terms 'editing' and 'manipulating' do have overlap in their sense it seemed also difficult to precisely indicate the relevant symbols on the position they belong to, because it happened to be that the 2 symbols were sometimes used for the same kind of action. Many reactions contained the frustrating what should be the exact meaning of both terms. And that is why the terms editing and manipulation had to be re-valued. Discussions resulted in the following explanation:

- 'editing' is the interactive change of elements in a map document. This will say that an interactive digital action is always mentioned as the term 'editing'. For the sake of security it is wise to create a separate file in order to keep original data from existing files.
- Automated actions to fundamentally change elements are called 'manipulating'. For example batchfile operations are called manipulation and the automated polygonising of area elements are also grouped under the term 'manipulating'. In most cases a new file is produced.

An other subject of change was the printing environment. Evaluation gave a lack of clarity and/or illegibility of the flow diagram. Reconsideration resulted into the introduction of the symbol for printing with the letter -P-, which must be filled in the circular shape of the process symbol. The objective of this change was the omitting of the environment frame symbol which has led to many comments and which gave an undesirable effect on the legibility of the diagram.

Other changes have led to a somewhat cosmetic alteration resulting in an improvement of legibility of flow diagrams. The computer and software environment line symbol has received a grey colour design instead of the dominating thick black line element.

3 Finalisation of the symbol establishment

The symbol design and the establishment for the flow diagrams was rather time intensive but discussions before, during and after were fruitful. A variety of users and potential users participated in the evaluations of the design of the symbols. The potential main conflicts mainly appeared at the beginning phase of the discussions involving more fundamental questions marks such as:

- What should be the fundament of the symbolisation?
- Do we make use of existing symbolisation like used in the flow charts for programming?
- Can we bring a relation with the existing flow diagrams for traditional cartographic production?

Without exaggeration it can be said that the benefit of the outcome is great, as seen underhere.

- the symbols are upgraded from temporary and draft to final and neat.
- the symbolisation has upgraded to standardisation level, which implies a recognition of the actual flow diagram for cartographic production environment.
- proper management and executive production have received proper guides that can be tools for everybody involved in map making.

From this time on a cartographic production can be guided by elements that have a valuable function for the 'users' of flow diagrams.

The publication of this all will probably be done during the ICA Barcelona conference. The coming years will be spent for attempts to convince people to work with the standard flow diagram system.

4 Standardisation

The effort which has been put into the design and establishment of the symbols must be followed by the acceptance of the staff involved in the production environment. of cartographic processes. So far there is some hesitation to adapt a flow chart system, due to either lacking time for some study or not willing to spend time in the unusual phenomena of flow diagrams. It seems that everybody is much involved in the adoption of digital technology rather than reserving time for flow chart symbology implementation. With respect to digital production it is of essential importance to import a structural system to give a maximum benefit for everyone dealing with digital processes.

Users must get awareness to use it. They should have to be convinced of the advantages of the implementation of such a system in the production sphere. Discussions on both management level and operating level must bring a more open mind towards the applying of the proposed methodology.

It is therefore of great importance that the proposed designed symbolisation and the way the symbols are designed and constructed to an acceptable working graphical display will be established to an international standard.

Why is a standard required?

To answer the question another question has to be replied first:

Why is a flow diagram symbolisation needed for an overview display of a production line?

It is of great need that a system must be available for managing production processes. This is the case for all dealing with production or production simulation: managers, operators and students. Until now:

- too much time is spent for production execution.
- too many mistakes are made due to the lack of overview.
- too many uncertainty factors are involved in production steps, and
- above all there is no proper planning possible other than a roughly estimation without a sense of real figures.

The above described are facts in the traditional production but particularly in the digital production. The digital environment is namely virtual and important elements are quite often not always visible. All the production is experienced in the heart of the computer, the CPU and the hard disk. Although the digital production is a physical process the information is digital and although the data is permanent it is only made visible through monitor and output. Only a detailed graphic simulation display like a flow diagram allows proper views on items like management and operative production.

If one is now convinced on the use and the need for applying a system for production overview it is then a matter of sense to adapt a methodology not only to be applied for one process, not only for one production line, not only for one section in a department, not only for one institute, but for many organisations dealing with cartographic production, preferably for the entire cartographic production community and perhaps in other disciplines than cartography, like the entire Geoinformation field. Advantages are especially available for production organisations dealing with various products.

The omitting of a flow diagram is so evidently negative and the advantages are so clear that flow diagrams are indispensable. A planner cannot rely on time, labour and system occupation if the details in

the planning are absent. In other words proper production and proper production management requires flow diagram methodology.

Examples of beneficial effects for potential users.

In the table underneath the most used practical tools are written down and the employees who can potentially make use of the tools are indicated. Teachers educating students to the production environment are not listed but suppose to deal with all the advantages applying flow diagram symbology.

4.1 Flow diagrams as a tool for estimation on (prior to production execution)

<i>item:</i>	<i>especially useful for:</i>
a time	for operator and manager
b availability of software	for operator and manager
c occupation equipment	for manager
d skills of employees	for operator and manager
e cost calculation.	for manager

a. If the diagrams are applied for time estimation both operator and manager have to check from step to step the amount of time which has to be spent for a particular element in the process. Thereafter an entire process consumption time can be calculated as an addition sum of all the steps in the process. Time estimation is required for employee's time involvement, thus availability during a certain period.

b. The aspect of software availability is often undervalued. This is not the case if a multi-user application software has been purchased. However in a DeskTop environment it frequently happens that a software program or a program module is available for single use only. This might lead to a conflict with respect to availability.

c. A more serious potential conflict is the availability of devices. In the digital environment it particularly gives a problem if digital production hardware is just limited available. Related to the point c. the manager is always confronted with the fact that not enough occupation results into a loss of money, while a too tight planning gives conflict if there is delay in earlier production. In practice one notices not always a one hundred per cent occupation.

d. In order to meet the qualification to apply hardware and software the skills and knowledge suppose to be as updated as possible. Since technological change increasingly sooner takes place this item should pay as a very serious attention to both the cartographic operator and the manager. Both should be aware of the proper knowledge and skill level of the operator and if correct this must be realised prior to the actual production process represented by the flow diagram symbolisation

e. It is obvious that the heart of a successful management is a proper cost calculation, prior to production but also during and after a cartographic process. Applying the flow diagrams the manager possesses a magnificent tool. The details of the production and their related symbols in the diagrams possess the true elements to exactly know the steps to be followed. Each element in the flow diagram can represent a time figure and an addition of all the times multiplied by the salary price of the operator(s) result to exact cost figures.

4.2 Flow diagrams as a tool for control during production

<i>item:</i>	<i>especially useful for:</i>
a on quality of each step	for operator and manager
b on time of each step	for operator and manager
c progress of the process	for operator and manager

a. Quality insurance becomes increasingly important. Since digital technology does not allow physical hard copy control easily decision steps have to be implemented in order to build in quality controls. An ideal tool for the steps are the flow diagram symbols that are already available for the manager, because if good he has the flow diagram available, already.

Each step represents an other situation or action, in each step a check on quality can be execute and therefore the described diagrams are ideal quality control instruments.

b. As described in a.

c. In principle this point relates to time check very much. However, it could be of great advantage just to know at which step a certain process is at a certain time and how much time it still takes for finishing a certain production process. This is an ongoing affair for both operator and manager and is the most frequently applied purpose of a flow diagram.

4.3 Flow diagrams as a tool for evaluation of:

<i>item:</i>	<i>especially useful for:</i>
a. time consumption	for manager
b. difficulties which were met	for manager and operator
c. skills/knowledge	for manager

As evaluation is the basis for the repetitive processes one should consequently and frequently make use of it. Evaluation results in figures and situations delivering historical data that can be applied for new planning of processes. Item b. is specifically useful..

a. As described in section 4.1 item a.

b. If problem issues like too much time consumption to a certain step or steps of a process the information can act as a fundament for newer planning. But not only time constraints are valuable. With respect to convertibility and exchangeability of files and derived proper solutions new data can be implemented in the planning for later production processes.

c. If employees lack basic skills and knowledge for the proper execution of tasks one should consider to either improve by study/development, or change persons if all becomes very serious for the continuation of the production.

A similar problem appears for the manager if he fails to know the details of the process. Therefore a close corporation should be provided for production planning, progress watching and evaluation

If one has been convinced on the use of flow diagrams an other critical part has to be surmount. An important issue is the quantification and the proper classification and their relation with graphic attributes of the map features. In existing cartographic data bases and cartographic products like maps a proper structure for map elements is a requisite. A flow diagram itself can not comprise details like feature levels, styles and other codes. The legibility of diagrams would dramatically reduce and the size would expend to multiple sheets of paper.

In order to avoid any omitting of elements and the related graphic attributes a special table of contents was designed supporting the operator with his task to save map elements on a required layer of information. For example a water element like a canal must be saved on an other layer of information than the river layer or the main road layer.

So far many people dealing with any production step on any level in the organisation were not aware of the absence of flow diagram methodology. But investigations have shown that the absence of flow diagrams in a proper production organisation takes twice as much production time than if flow diagram is applied. It is proved that if assisted by a flow diagram the total production speed by a cartographic operator increases 30 per cent due to the systematic approach of the process. And it is known that applying a flow diagram during production the computer occupation reduces to 50 % of the time.

5 Quality on production and quantification of time spent on production

The discussion on the use of adapting a system must also involve issues like the quality of the processes and the number of steps in the process, the time estimation on consumption of production time and production steps and the conversations on quality and quantity of human resources to be applied, both operators and management employees.

Using a standard would also increase clarity amongst institutions dealing with each others data and data files for whatever process one uses. For instance if one considers the exchange of data files and the further continuation of the process in other production environments it should be evident that overviews like flow diagrams would obviate much unclarity in for example exchangeability of formats and source documents and convertibility.

For databases a similar methodology is also required. The next step will be the investigation in the further development of the system to manage production processes. One can expect a continuation of the development process, because there is also a great demand on that. And above all this aspect is in the same line/level like the other part of the production processes.

A preparation guide for the proper graphical description of data bases has been found in the development of forms to group, classify and attribute map features.

feature descriptor	vector data				raster data							
	group number	index number	vector type	vector size	byte number	color number	then status	data table id	data to bit	color number	color id	

feature group	feature class	feature element	layer level number	layer level name	segment (Flash and CoreDraw)	line weight	line colour	area colour	other info
roads	main road	centre line	2	main road centre line	main road centre line	0.1	none		
		road casing	3	main road casing	main road casing	2	black		
		4	main road	main road	1.4	ITC 440			
secondary road	secondary road	centre line	5	sec road centre line	sec. road centre line	0.1	none		
		sec. road casing	6	sec. road casing	sec. road casing	1.6	black		
		7	sec. road	sec. road	1.2	ITC 500			
water	main river	centre line	10	main river centre line	main river centre line	0.1	none		
		casing	11	main river casing	main river casing	2	ITC 006		
		12	main river	main river	1.4	ITC 003			

6 All the symbols in an overview
















If symbols are available the cartographic operator requires a library. This original of all the existing symbols is stored on the hard disk of the computer to be used. Preferably the library must be ready for any program to be applied or at least convertible for the software which will be required for the production of a diagram for production scheming.

From the original file the symbols have to be copied and dragged to a new file. The file is then filled up with all the required symbols. Existing symbols are always duplicated and moved to the proper places. The following tables show all the available diagram symbols listed in the following classification:

6.1 product symbols

All the symbols that are representing products like files, tables, external storage media and hard copies like sheets of film or paper. Explanation of the symbols is given and the symbols have been classified according to analog production and digital processes.

ICA/ITC SYMBOLS FOR CARTOGRAPHIC FLOW-DIAGRAMS

		SYMBOL WITH EXPLANATION	NAME AND DESCRIPTION
PRODUCTS	analogous	 with reference-number, description, positive/negative-expression, material-specification and reading/wrong reading-expression	reprographic product A product that proceeds from a reprographic process like a camera-shot or an in-contact exposure.
		 with reference-number, description, positive/negative-expression, material-specification and reading/wrong reading-expression	corresponding reprographic products Two or more strongly resembling reprographic products, for example by being a series production. Each product has an own reference-number or all the products have a collective one.
PRODUCTS	analogous/digital	 with reference-number, description, positive/negative-expression, material-specification and reading/wrong reading-expression	product Any product like a map-specification (standardized or not), an intermediate product (non-reprographic) or a test-map (plot, print or proof).
		 with reference-number, description, positive/negative-expression, material-specification and reading/wrong reading-expression	corresponding products Two or more strongly resembling products with either each an apart, or together a universal reference-number.
		 with reference-number and description	list As a rule a table with the alpha-numerical data that have to be mapped, in that respect also source-material.
		 with reference-number and description	corresponding lists Two or more alpha-numerical lists that resemble strongly with either each a specific or together a general reference-number.
		 with reference-number and description	help-product An 'inter-product' in, on or from which the planimetric positioning is of minor importance, like it is for text that still has to be placed.
		 with reference-number and description	corresponding help-products Two or more strongly resembling help-products with two or more individual reference-numbers or one common reference-number.
		 with reference-number, description, extension, name and raster/vector-expression	internal file A file in the work-memory or on the hard-disk of a computer, either in use or not in use.
PRODUCTS	digital	 with reference-number, description, extension, name and raster/vector-expression	corresponding internal files Two or more files that resemble strongly and might be open as well as closed; each file has a specific or all the files have a general reference-number.
		 with reference-number, description and type-specification	internal sub-file A file that falls under an other file, like a library, a template or a window.
		 with reference-number, description and type-specification	corresponding internal sub-files Two or more strongly resembling sub-files with two or more individual reference-numbers or one common reference-number.
		 with reference-number and with or without medium-code, name and extension	external file A file that is not directly accessible because it's stored on an external medium, well-known media are tape and diskette.
		 with reference-number and with or without medium-code, name and extension	corresponding external files Two or more strongly resembling, external stored files, with one reference-number or with two or more reference-numbers.
		 with reference-number and with or without medium-code, name and extension	

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Figures are displayed at 50 % reduction of the real size

6.2 process symbols

The symbols representing processes like scanning, digitising, camera reproduction and contact reproduction. The symbols show actions and therefore they are fundamentally different from the product symbols. The classification of these symbols has also been arranged according to the existing technologies.

ICA/ITC SYMBOLS FOR CARTOGRAPHIC FLOW-DIAGRAMS

	SYMBOL WITH EXPLANATION	NAME AND DESCRIPTION		
PROCESSES	engine	... with or without exposure-specifications	In-contact exposure A normal side to side-exposure in a contact-frame or contact-case.	
		... with or without exposure-specifications	exposure with in-between film An exposure like a normal in-contact exposure, but with an in-between film, frequently used for getting test free from the background.	
		... with or without exposure-specifications	exposure through the base An exposure in a contact-frame or contact-case, whereby the film is exposed through the base.	
		... with or without exposure-specifications	exposure through the base with in-between film An exposure like a normal exposure through the base, but with an extra, in-between film.	
		... with or without exposure-specifications	In-contact exposure with normal screen An exposure in a contact-frame or contact-case, using a screen, things like percentage screen density, screen angle and screen type are to be specified.	
		... with or without exposure-specifications	In-contact exposure with special screen The screen used at this in-contact exposure, is more or less specific; that for it normally will be specified.	
		... with or without shot-specifications	camera-shot A shot with a reproduction-camera, things like prim-application and scale-transformation can be specified.	
		... with or without shot-specifications	camera-shot with filter A shot with a camera, using a filter, the filter is to be specified.	
		... with or without shot-specifications	camera-shot with filter and screen A camera-shot whereby a filter as well as a screen is used, the filter and the screen can be specified.	
		... with or without print-specifications	offset-printing The - final - printing on an offset-press whereby print order, colour order and press type can be specified.	
		... with or without print-specifications	screen-printing The - final - printing on a silkscreen-press, things like print order and colour order are to be specified.	
		misc	... with or without criterium	Judgement A judgement of a product or process; as a switch in a 'loop' it often defines the production-progress.
			... with logical character and with or without specifications	keyboard-input Entering data by the keyboard, for example for the input of preferences, resulting in a new file.
... with logical character and with or without specifications	digitizing In any way, with a digitizer, on the screen or in another way, digitizing map-elements, resulting in a new file.			
... with logical character and with or without specifications	scanning Making a scan of existing map-material; to be specified are among other things the resolutions, mostly if new file is shaped.			
... with logical character and with or without specifications	manipulation Manipulating a file whereby a new file is created, back-file- and data-reduction-processes are included as well.			
... with logical character and with or without specifications	conversion Converting a file, what normally results in a new file in an other format with a modified extension.			
... with logical character and with or without specifications	free A - digital - process that doesn't fall under the five 'standard-processes', like a print, then the logical character is 'P', nevertheless the filing in is free.			

Figures are displayed at 50% reduction of the real size

6.3 reference symbols

Symbols referring to previous or following steps of a process or a product. How the hardware and software environment are displayed can be seen underneath. It is necessary that a clear link has to be made from one part of a process to another. A non-broken line connects the relevant symbols. Lines have to be applied with an arrow orientated in the destination direction. If the cartographic operator just has to refer to an existing file, sheet of paper or other matters a pecked line has to be drawn with an arrow.

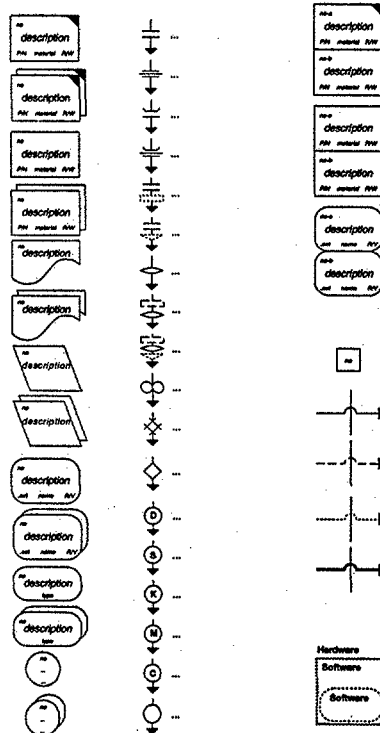
It is desirable to not make a final version immediately. Preferably a first draft (as a kind of proposal) has to be prepared. One might consider this proposal as a kind of sketch model. A second draft diagram is often inevitable. Corrections to the latter one result into a final neat version of a flow diagram for an entire production.

The library as shown on the right is an example of symbols in a pretty arbitrary way. All the symbols are displayed at 50% reduction of the real size.

		SYMBOL WITH EXPLANATION	NAME AND DESCRIPTION
LINKS	analog/digital	with reference-number	reference-foot A reference to the product with the reference-number rendered in it, thus to be seen as a 'go-to-instruction'; sometimes useful in complex diagrams.
	digital	with or without arrow and cross-bow	reference A relation between products, stages and processes, concerning a reference for or 'a consultation from'; frequently used for referring to predefined specifications.
		with or without arrow and cross-bow	process-origines A relation between products, stages processes and platforms, concerning the progress of the production-process; in that respect it also indicates more or less 'the order'.
digital	with or without arrow and cross-bow	screen-rendering A relation between products, stages and processes, concerning a temporary rendering on the screen, like usual when a scanned image is digitized on the screen.	
	with or without arrow and cross-bow	cable-connection A relation between products, stages, processes and platforms, concerning a direct connection by a cable, for example between a computer and a scanner or plotter.	

		SYMBOL WITH EXPLANATION	NAME AND DESCRIPTION
PLATFORMS	digital	Hardware with description	hardware-configuration The limitation of a hardware-configuration, that crosses the diagram and in which as a rule one or more software-environments are limited.
		Software with name	software-environment The limitation of a software-environment, that crosses the diagram, always within the limitation of a hardware-configuration.

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7 The potential steps of management involvement in flow diagrams

In this section an entire production is displayed by means of flow diagram symbolisation. Potential check points are explicitly indicated in order to indicate whether and what kind of specific control can be executed.

The following items for control can be consulted:

7.1 *Keeping track of a production process*

The step to step supervision whether tasks have been executed by the operating cartographer. Product symbols serve as check points for the determination of the progress of a map production. The manager or the operator might draw a tick mark if a specific part of the production has been done. This kind of control is done for any part of a production process.

For a helping aid all the relevant product symbols have been marked with the letter -a-.

7.2 *Quality control*

One of the tasks of managers and operators is often the check on the quality of an entire production process or a part of it. Just like in traditional production digital production requires fixed quality checks. This can be denoted by writing numbers or figures beside or within the required symbolised process element. In our examples the letter -b- is used.

7.3 *Time spent on production step*

For the supervision on time consumption for the preparation of process steps an estimation has to be made of the amount of time which must be consumed for the preparation of a certain part of the process. The time spent on production elements can be indicated for all process steps.

7.4 *Occupation of hardware and software*

For the planning of the use of equipment occupation a total figure has to be given for expected use of hardware, quite often in combination with available software. The figures will be the sum of all the expected production tasks. A figure number outside an environment symbol indicates the occupation time for a configuration and tells the manager when the operator can start a next mapping process.

8 Conclusion

This paper introduces a proposed standard for mapping projects and the managing of it. The paper describes the individual elements in production processes and gives examples of the symbolisation of parts of an entire process. It explains which situations relate to which symbols and it overviews complete production flow lines. The input from GIS can be introduced into a process, as well, so that this important item is implemented and symbolised, for a flow diagram.

The flow diagram system like described should be upgraded to an international standard, because the close corporation of the (international) ICA Commission on Map Production Technology and the International Institute for Aerospace Survey and Earth Sciences (ITC). The two organisations are internationally well known and have the power to provide the international cartographic society with newest information. Both organisations have easy access to new information. From now on production organisations or mapping education institutes can be provided with a managing tool system that creates very useful guides for cartographic operators, map education staff and institute managers responsible for cartographic products.