Geographic Information in the ICT's era

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Geographic information is an ancient human production that traces its roots back to pre-historical times. The first maps date back to Antiquity and the oldest of them exists today in the form of a clay tablet which represents the world with Babylon at its centre (Madan, 1997). If geography as a scientific discipline did not as yet exist, geographic information was already an established domain with well-known Greek philosophers such as Thales of Miletus, Herodotus, Eratosthenes contributing to the general knowledge of the time. It is to be noted that Hecateus (c. 550-480 B.C.) who, although not a philosopher, has left behind one of the oldest maps known to mankind. Similarly, he is also credited with two geographical works, the first on Europe and the second on Libya (Africa plus Asia) (Husain, 2001).

However since these were all works of a single individual (or groups of individuals), it is not possible to view them as « scientific » in the modern sense of the term. Moreover, the works being manuscripts, their distribution too was generally restricted. A first revolution of sorts took place with the invention of the printing press in 1454 which saw a greater propagation of the written text. The major milestone however, was achieved only in the 17th century with the contribution made by the scientific societies which began exchanging or rather disseminating their depository of ideas and knowledge. In 1660, the Royal Society was founded in London. It was the first society to use paper as a supporting tool for circulating information regarding its activities. If knowledge thus began to be progressively disseminated, it was only with the advent of the 20th century that the scientific journals (i.e peer reviewed) made their first entry. The propagation of « sealed » scientific knowledge is therefore a recent phenomenon. It is however an extremely important phenomenon given the fact that there are 20.000 scientific journals in the world today (Rucinque, Durango-Vertel, 2003).

The volume of geographic information, academic or otherwise, has only increased in the course of the 20th century with the coming of age of the software industry. The micro-computer especially has radically transformed the field of geographic information. First, the output capacity (data collection, management and processing) knew a stupendous growth. Next, the methods of working and publishing one's work were transformed thanks to the appearance of user friendly computers in the 1990s and the usage of the Internet. The 21st

century assuredly marked the turning point in the history of the transmission of geographic information.

We will not revert here to the changes that characterized the other areas especially those pertaining to the office revolution. Rather we will attempt to point out the inroads made by these new tools in terms of the output and distribution of geographic information.

We will study first the manner in which the output of geographic information has increased and diversified due to the setting up of data production, storage and managing systems. From tables copied from the registers and subsequently drawn by hand, we have graduated to databases that are updated in real time and which automatically produce maps of their spatial distribution. The development of micro-computers and their greatly increased data storage and processing capacity has made considerable impact on several aspects of geographic information, the most important being the creation of the Geographical Information System (GIS).

This gain in information was accompanied by an equally important distributional network thanks to the new horizons opened up by the ICT. Hence, the usage of the CD-ROM and Internet has rapidly spread new information, broadening the circle of readers that comprised mostly of geographers and carried the discipline into the heart of an ever increasing network of cyber users : governments, NGOs, corporate houses not to mention the general public.

A. <u>The new perspectives of production of geographic information :</u>

The « traditional » methods of map-drawing were manual. The supporting base, i.e paper, had one great advantage: it was popular and relatively inexpensive. However, the costs of production and above all, reproduction, were rather high and this transformed the map into an expensive ornamental piece. Hence, the first map of Bengal by Major Rennell was intended as the illustration of a book. Similarly, Robert Clive had other maps drawn by Rennell for his private collection (Raj, 2003). Also, these maps circulated with great difficulty and their updating was a very costly affair. This situation remained unchanged until the 20th century when the progress made by the publishing industry was due primarily to the inroads made by the printing press. However, it is the entry into the digital era which was to radically transform the production scenario.

The possibility to draw maps on micro-computers acted as the catalyst. The first computer drawn map dates back to 1963 and the following years saw the appearance of the first batch of software programmes pertaining to geographic information. The actual take-off however happened only in the 70’s due primarily to North American private and public sector

investments. The 1980s saw these software programmes develop in Europe, Australia and Japan. Towards the end of the decade, the many geographic, cartographic and software developments led to the concept of geomatic based on the appearance of a new instrument – the Geographical Information Systems (Burrough, Mc Donnell, 1998).

The difference between an information system (i.e. a database and its related software) and a geographical information system is that the latter is equipped to deal with the spatial attributes of the elements in the database or in other words, their geographic location. The localisation is undertaken with the help of two additional features: the form and the positioning of the object vis-à-vis the surface of the earth. In terms of analysis, the SIG is subsequently capable of mapping these objects (which is already being undertaken by the relevant cartographic software programmes) as also to incorporate as well as generate new data such as the relative positioning of the objects. Further research in the fields of spatial analysis and cartography hold out great promise for the future

However, these software programmes, up until the beginning of the 90s, were monopolised primarily by rich research centres as no private investor could afford to meet their high requirements in terms of data storage and processing. In fact, in addition to the statistical aspect, there was also the graphic dimension of the objects as well as the geographical nature of the operations which greatly increased the need for funds. Since then, the GIS has followed the general evolution of the micro-computer industry and has become democratized to a great extent with pirated GSI software programmes being floated even today…

1. Technical developments of geographic information output

In order to generate information, one has to first assemble it. However, the collection of geographical data is a costly affair: to the traditional collection of data is added the costs of its geographic localisation. What is more, the volume of data stored is thereby also increased. As regards physical and topographical data, remote sensing today has considerably augmented the mass of information available. By associating GIS with the information relayed by satellites, we can pinpoint the location of most of the objects on earth. Altitudinal differences, the localisation of urban expansion or cultural variations from one year to the other can well be viewed from space. A good example of the progress made in the field of the collection of geographical data is provided by the maps of the Indian metropolis by Eicher. These maps which were assigned to a specialised society for completion cost three times less than those developed from a traditional database and have less number of errors. (http://www.inrimt.com/).

These databases are nonetheless expensive even though they are more and more readily available on Internet free of charge (we can thus obtain a satellite image of Chennai on the website http://www.spaceimaging.com/). The DCW database is certainly the most well known. It assembles a wide range of information (i.e. altitude, drainage, cities…) for the whole of the planet. The information however is dated since having been earlier on sale, it saw its profit margin go up thereby enabling a free distribution. It constitutes nonetheless an ideal basis for undertaking new work or obtaining instantaneous information on the majority of the sites on this planet.

As regards the collection of social data, it is more complex. As in the case of the census, individual interrogation is required. However, data collection remains relatively simple as this depends primarily on the availability of the individuals for a survey – which is not much of a problem in a country like India…

However, there are different phases between the collection of data and the distribution of data in a manner that would make it available to the maximum number of people. Hence the traditional mode of distribution i.e. the publication of tables in the district Census handbooks seemed to confine its circulation essentially to a few wealthy libraries (and this despite the low price per volume) with the requisite space : the publications concerning each village in the State of Tamil Nadu comprise more than 15.000 pages while the very same data on an all India basis has been confined to a single CD-ROM. Data storage in the modern day context is no longer a problem and the development of other new systems such as the DVD for example only serves to further undermine space constraints.

The Indian Census, the most important in the world today in terms of its size and regularity, is a good illustration of the fact that both rapid data collection and distribution of results can be made possible. The data is collected at the village level and subsequently centralised according to a system of hierarchy that leads up to New Delhi. The entire results of the 1991 Census (at the village level) were made available on floppy three years later and it is hoped that the same happens for the 2001 Census as well. It is to be recalled here that the last publications on paper per district appeared on the contrary only in 2000. The benefits derived from technological innovation cannot be ignored in this instance. More generally speaking, the introduction of computers at administrative levels as well as the usage of GIS saw the results of the last Census published in less than 6 months: the 2001 Census was completed on the last day of February and the first report published in the month of June. The initial reports already contained State wise maps while those published later included maps per district. In academic circles, the first map to be based on the Census results dates back to

February 2002. It depicts an appraisal of the fertility level per district (Guilmoto, Rajan, 2002). The circulation of geographic information had become veritably rapid !

The development of more powerful micro-computers with a greater capacity for personal data storage has opened up new horizons. However certain drawbacks continue to persist. The first concerns the non-availability of a specific database of local maps in India which is difficult to access since the maps are rare if not altogether non-existent or protected by the law[i].

Hence the map is a rare commodity in India. It is rarely published by private editors and even when published, the quality of the publication is extremely mediocre. Amongst the major public editors is the Survey of India which is committed to map publication as well as the Census of India which produces maps in order to situate the census blocks. The pricing in these instances is reasonable the only drawback being the cartography which is relatively simple thereby forcing the reader to combine it with other sources in order to get a complete picture.

The biggest problem however remains without any doubt the obtaining of Government authorization necessary for acquiring and publishing maps in India. Hence the maps produced by the Survey of India are not meant to be exported outside the country. Similarly and more generally, it is also forbidden to publish maps that depict some of the more strategic locations (military zones of course but also more generally, water dams and coastal regions) in India. As opposed to this, the more advanced nations (with the US leading) have several maps on display on Internet for free without any Government imposed restrictions.[ii]. In addition to the ordinary citizen who has paid for the information with his taxes and can therefore access it gratuitously and directly, the general economy of these countries too stand to benefit since the information circulates cheaply and more speedily. Following the example of the readers of the magazine GIS@development (letter to the editor published in September 2001 - www.gisdevelopment.net), we too can question here the validity of measures that seek to penalize the Indians at a time when an image relayed via satellite from an American or European server takes no more than a few hours…

If the problems pertaining to the collection of primary data still poses a problem, the new systems at our disposal now enable us to cope better with the current information. Hence map drawing and spatial analysis have only grown more accurate and more complex since the last 10 years. From traditional cartography at the district level (sometimes taluks) which was the hallmark of the results published formerly by the Census, we have gone on to a more in-depth

analysis of spatial demarcation (a sample of the perspectives is provided by Guilmoto *et al.*, 2002 & Oliveau, forthcoming).

Technically speaking, there have been two major milestones : first the distribution of cartographic tools for the whole of the population and second, the appearance of new systems targeted at professionals in the field.

Data processing was considered until recently just as fastidious an operation as map-drawing. Hence, in order to produce a map, one had to go through a statistical analysis of the data prior to selecting their mode of representation. However, the development of more and more advanced software technologies containing all the steps required to produce a map as well as guidelines for the user, has considerably democratised the operation. The « press button » enables just about anybody to produce his own map as well as to modify it within real time. Gone are the hours spent in hand drawing one's map only to realise at the end that the result does not quite correspond to the picture that one had in mind! The most blatant example of this democratisation is undoubtedly the integration of a cartographic module in the Microsoft Excel software package.

However, the most happening place is undoubtedly the world of « map-making professionals » . First, this community has grown and many non-professionals today have also begun to produce geographic information as the presence of a map synthesises the information as well as adds to it. Now all the disciplines comprise of a cartographic study however summary. The localisation of entities has become simpler and forms today part of the supply of « basic » information. Moreover, the maps have become more and more complex. We have illustrated the « accuracy » of cartography today but one need also to speak of its « diversity » with the temporal dimension added to the spatial one.

Similarly, with increased cartographic accuracy in terms of the size of the location depicted, it is becoming necessary to resort to smoothening methods (known as spatial smoothing since space is integrated) in order to retain the synthesising aspect of information. The underlying principle is simple: it suffices for each point to smoothen or balance its value with the value of the points taken from its neighbours in order to obtain the average value of the location. The errors are thus distributed or « spaced » out. What is more, this method compensates for the lack of value of certain points and enables their calculation. Instead of a map covering all the units, we have one on spatial tendencies. We can find an example of this kind of cartography on the website of the Atlas of South India (Oliveau, forthcoming) : these illustrate well the regional tendencies of the entities observed by doing away with the rigidity of the administrative frame-work such as the taluks or districts in India.

To conclude, we shall synthesise the contribution of the new technologies towards geographic production by underlining the most important change brought about. From a rigid system of map-drawing where each step was assigned to an individual (or institution) specialising in the subject, we have made the transition to a post-modern era where the map produced collects data and circulates on its own leading to a multiplication and diversification of results.

B. The development of the distribution of geographic information

If the contribution of technology in the field of geographic information production is undeniable, it is certainly in the area of its distribution that it is the most spectacular. After all, what is the use of information (whether geographic or not) if it is restricted to a few alone?

Hence, we shall first study in a general manner some of the new Medias at the disposal of the geographers and subsequently back these up with examples in the Indian context which will enable us to affirm that the countries of the South in this instance have much to gain from the ICT sector. Two kinds of media have contributed immensely to the rapid distribution of geographic information: the CD-ROM and the world wide web.

a) New media : the CD-ROM

Even before the coming of the CD-ROM, there were other methods of data storage and distribution (namely the floppy). This does not interest us even though the first numerical Atlas was circulated via this method. It is the CD-ROM however which has ushered in a veritable revolution in the field of information distribution. The CD-Rom which made its first appearance in 1984, has a much greater capacity for data storage which is ideal for storing geographic information which, as we have seen earlier, combines both data and graphics. In addition to its greater storage capacity, the CD-ROM has other unique features i.e. long life and resistance which have made it a favourite over other Medias.

What has given the CD-ROM its cutting edge over paper? In fact, only one section of geographic information i.e. the atlas and data collection have turned towards this new media. The journals and the traditional volumes have not been replaced. For data collection, the example of the Census is eloquent enough for us not to refer to it here again. As regards statistical analysis, it cannot be envisaged without the help of the computer. Paper publication has subsequently become redundant.

In the case of the atlas, the reasons are dual. First, there is the financial aspect. The publication of colour illustrations is a costly business. The CD-ROM, on the contrary, sees its

price fluctuate only in the event of an increase in its volume. In the case of paper publication, each additional page adds to the cost of printing while the CD-ROM has no additional costs in this instance. Hence it is cost-effective to add more maps on a CD-ROM. In the earlier instance, only those Atlas volumes that were subsidized or were much in demand could be edited. In the case of the CD-ROM, the Atlas could be produced from an individual village and circulated. In any case, this is practically what has happened in certain countries (for example France) where regions have subsidized the cost of publication of an Atlas that describes it.

However, the other advantage regarding the CD-ROM was that it could abandon the statistical aspect of the traditional Atlas by incorporating matter relating to the map. Hence we first witnessed the integration of multimedia elements in the Atlas that served to describe the region with the help of photos, audio and video cassettes. The next step was the pure and simple integration of the data accompanied by a visual software package that enabled the user to draw his own map based on the data provided or even to locate the information visually by merely clicking on any object in the Atlas.

The CD-ROM seemed thus to symbolise the epitome of a new interactive and user-friendly media which was a boon of the New Information Technology. The data storage capacity, considered colossal at the time, seemed to largely suffice. Today, the DVD has come to replace the CD-ROM thanks to its more innovative qualities which have rendered the contents even more rich and varied.

b) <u>New Media : The Web</u>

However, even though the CD-ROM enables the storage and the distribution of a large volume of data, it nonetheless retains one of the drawbacks of paper publication: it is not always easily accessible and it is often difficult to have it delivered from a distant corner of the globe. First one has to be aware of its existence and secondly, one has to bear the delivery charges of the CD which are rather high.

There is however another form of media at the heart of the ICT which also characterizes it: the Internet, which is a global network of existing networks (inter-networks). Internet represents the evolution of older networks, of which ARPANET is the most well-known. More than Internet however, it is the creation of the hypertext link (or hyperlink) which has revolutionized the communicational network. Created at the end of 1989 by Tim Berners-Lee at CERN (European research centre for the Physics of Particles http://public.web.cern.ch/) at

Geneva, the hypertext links have enabled the setting up of the World Wide Web (also known as Web) which the Internet today has come to symbolize.

In fact, the hyperlinks have made connectivity possible between documents found in different parts of the world. The creation of the Mosaic software in 1993 and above all that of Netscape in 1994 led to the world wide boom of the web. For the first time, this user-friendly software made it possible to consult documents “online” i.e. on the web. The major contribution of the web is the facility to globally avail of data at the click of a mouse.

Hence it has become possible to gradually publish results, to discuss them as well as to share information. The potentiality of the web (and more globally, Internet) has not as yet been sounded to the utmost but the present results are already highly appreciable. In addition to group exchanges between interested parties (via forums, user groups, etc.), it is also possible to acquire certain non-available materials (second hand books, volumes published abroad, etc.), access data as also maps which range from static maps similar to the paper volume Atlas to interactive maps where it is possible to create one’s own map, the selection being from zooming maps to modifiable ones. The interactive attributes of the CD-ROM is found on the WEB with two additional features: the first concerns the possibility of updates in real time while the second is related to connectivity with external sources, i.e. other websites.

More generally, the far-away resources assume an identity which constitutes a first step. Next, they become utilisable which partially bridges the gap between them – physical gap between two places, monetary gap between the rich and the poor. However, the question pertaining to the financial angle remains: some vote for a general and gratuitous exchange of information while others seek to turn the Web into a huge shopping mall.

There are also certain constraints on the use of the Web and one can only hope that these will vanish in time. The first concerns the expense of the related equipment. In addition to the « standard » equipment (a computer), one also needs a connection to the global network (modem and above all access to a server). Moreover, the rapidity of connection is related to the volume of data transmitted. Hence videos and large databases continue to circulate better (but for how long?) on physical supports such as the CD and the DVD.

The CD and the web thus appear to complement one another. Hence, the CD offers the solution of a definite storage while the Internet enables updates in real time. The former permits the transmission of a large volume of data while the latter proposes an instantaneous networking of information. And both of them have the same advantage over paper publication : interactivity i.e. the possibility to intervene on the data. The user is no longer an « end-user » of information.

C. A few aplications in the Indian context

If the line of thought presented here is based partially on a study of what is actually happening in the western countries today, it would be now interesting to view some of the examples pertaining to the usage of the new Medias for distributing geographic information in India.

We will take up the same pattern followed until now by illustrating first the two examples of the CD-ROM. Next, we will see the two examples of the website which have an altogether different role to play in the distribution of geographic information in the Indian context.

1. From the CD point of view

In a country where the telecommunication industry was still at a nascent stage in terms of its quality and volume but possessed an efficiency that was all the more astonishing given the size of the country, the CD-ROM represented until recently the only reliable means of transmitting numerical information (the floppies are not particularly designed to travel in tropical countries...)

Moreover, since India boasts of an important community of software engineers, the elements for developing this support system were already present. However, lacking perhaps in a niche market, the CD-ROM did not experience any great boom which made the distribution of geographic information dependent on a single well-known distributor: Mapsofindia.

a) Mapsofindia CD

Mapsofindia (mapsofindia.com) was founded by the Compare Infobase Group specialising in the online business since 1997. The company had launched several years ago a free website that distributed online maps of India at various levels : from the national level to the district level. Since 2003, they are attempting to sell their entire collection of maps on CD-ROM. Internet access has actually shrunk the quality factor and most of the maps are now available only in a summary form.

The CD-Rom has a tremendous advantage: it does away with the constraints imposed by Internet viewing and allows a rapid perusal of this extremely rich collection of maps (more than 3500 maps available on the first CD, more than 250 available on the CD meant for schools). Since the target audience is primarily scholastic, the distribution strategy seems to be a good one: Internet for placing an order since the teaching community can easily access

Internet beyond working hours followed by CD-ROM support for preparation at home (for the more industrious) and distribution in the classroom.

Mapsofindia has thus established itself as a leader in the field of the distribution of maps in India. The maps taken from these CD-ROM have even figured in official reports and university works. Since the need for geographic information is latent, the timely positioning of Mapsofindia in this sector has enabled it to carve out a niche for itself.

However… geographic information in India is generated by an institution that produces quality maps – the Survey of India: the various Atlases produced, although old, are of relatively good quality. On the other hand, it is to be admitted that the maps produced by Mapsofindia are extremely mediocre. The content is lacking in precision, the locations are sometimes imaginary and some of the regions badly described. As regards the thematic maps, these do not respect the norms set by the Institution of Cartography and cannot in any way be compared to the maps proposed by institutions such as the Census of India. The main problem arises from the fact that there is no proper scientific management of this geographic output.

Only the CD-Rom interfacing is well done and the competition is zero. The efforts undertaken to distribute basic geographic information to the general public is only to be commended. We could expect a gradual improvement in the content of the collection presently offered but in the absence of competition, the private sector is not interested in entering the fray especially since the investments are heavy and the profits take long in coming. We can only hope that the Indian Government paves the way for the Survey of India to participate in the ICT era. Towards this end, it would be necessary to lift the restrictions imposed on the accessibility which would mean allowing people to produce them freely as well as providing the Survey of India with the requisite tools for its modernisation. The present website (http://www.surveyofindia.gov.in/) indicates that the efforts are well under way since it is now possible to access the list of maps available. However, what would be most appreciated would be a view of these maps or perhaps even a free distribution of the older or more general versions.

b) The SIPIS

An initiative undertaken by the scientific community is to be noted in terms of the distribution of scientific knowledge to the general public. This concerns the “South Indian Population Information System” (SIPIS). This project forms part of a wider study of fertility in the South of India which has set up a geographical database for the study of demographic elements at the French Institute of Pondicherry (http://ifpindia.org). Following several

requests from other scientific quarters as well as the NGOs, the distribution on a larger scale of this database has been decided with the financial backing of the UNFPA (United Nations Population Fund).

The CD-ROM has been chosen as the mode of distribution for this database to which would be added a tool for cartographic consultation. The project which covered a period of less than a year was confined to the State of Tamil Nadu. The initiative was above all directed towards the development of a user-friendly tool for consultation which would facilitate the transition from data to maps. From the point of view of geographic information, this project required the generation of new data calculated from a base of rough results yielded by the Census. The user in this instance has only to press a key in order to obtain the information solicited arranged as an alphabetical index or a map outlining the administrative boundaries. All statistical data has been classified into general groups (social, economic, employment, infrastructure etc). Similarly, a few synthetic maps have been provided in a raster format (literacy, fertility…) in order to assist the user in identifying regional tendencies.

The software programming has been done on the model of the tools developed by ESRI and the end product is similar to the existing software, *Arc Explorer*. The interface has nonetheless been rendered simple in order to facilitate its usage by non-professionals. A few options have been added, notably a help in Tamil[iii]. The result (Guilmoto *et al*., 2000) has received positive feedback especially since the FNUAP subsidization has prevented the price from going up. The volume of orders placed by SIPIS with the French Institute of Pondicherry has once again corroborated the basic need for geographic information in this country.

Nonetheless and as we shall see later, the usage of Internet on a massive scale in India has given a considerable boost to the information available.

2. <u>On the web</u>

It is around 1998 that Internet first began to be privately used on a large scale in India[iv]. However, getting connected still remained a tedious, difficult and expensive affair. Technological growth has today led to a steady decline in connection costs as well as a parallel increase in debit namely with the arrival of the fibre optic cable connection. The Indian websites, as a result, flourished. The stakes involved here are perhaps more high than elsewhere given the size and population of the country: the challenge posed by Internet to the decentralisation and distribution of information is considerable. It would seem however, that

the bureaucracy, who has often been criticised for its lack of dynamism, is capable, at least in some of the instances, of taking it up.

a) The Census Server

The instance of the Census can be cited as noteworthy in the domain of the distribution of information and especially that of geographic information. Following its usage of the CD-ROM since 1994 for distributing data collected only three years previously, the Census, by opening itself to the technological revolution, has hosted its own website which provides access to a wide variety of information as well as the results arrived at.

Hence, in addition to the 2001 Census results, the website also provides the 1991 results as well as some vital statistics. From the geographical angle, State-wise maps describing the districts in 1991 are hosted. We also find thematic maps illustrating the 2001 results and a comparison of the evolution from 1991 to 2001[v]. However, the most remarkable achievement of the Census remains undoubtedly the website « census GIS India » (http://www.censusindiamaps.net/) that it recently launched and consecrated entirely to the mapping of the 2001 results.

In fact, this particular website offers its visitors the results of the last held census in 2001in the form of maps which enable the user to have access to the data. The choice range is varied and is at the following levels: results at the state level on an all-Indian basis and results at the district level on a State-wise basis. Although the future of this website seems promising, we would like to signal two mandatory warnings. First, online publication is still in the evolutionary stage (it is one of the strong features underlined earlier) and the data is liable to disappear at times. We would have liked to retain the on-line results published previously but these have vanished. The storage of this data on CD-ROM would have helped retain it. Next, the non-initiated visitor of the Census results may be a little lost in the face of such mind-boggling array of information. However, this is one of the shortcomings of interactivity which necessitates a minimum training for the end user.

Amongst all the initiatives undertaken by the Indian Government to distribute information and to put a variety of maps at the disposal of the ordinary citizen, the Census has certainly been the most successful. However, we cannot afford to ignore in this instance some of the other efforts undertaken at the State level such as the GIS division of the Tamil branch of the National Informatics Centre for example (http://gisd.tn.nic.in/).

b) The Atlas of South India

It is with the objective of « saving » the reader from this « jungle » of statistics that we have formulated the idea of an on-line Atlas (Oliveau, forthcoming). In fact, following the success of our data publication via SIPIS and the positive feedback received regarding the Census website, we decided to propose the idea of an Atlas that can be viewed as complementary to these two projects already initiated. The advantage of the Atlas over a data bank for the distribution of geographic information is both graphic and scientific. Graphic first, as data are immediately readable under map format. Scientific then, as the information has been filtered: the researchers have selected the maps to be presented in function of their interest and a certain thematic classification. Moreover, the maps have been commented upon and updated.

The choice of an online Atlas was obvious: quasi free storage on Internet, high storage capacity (the number of maps is practically unlimited), simplified comparison (by switching the levels, a local phenomenon can be placed in a regional, national or international context) and rapidly updated with the collection of fresh data.

There were certain technical problems regarding the setting up of the website. First, the difficulty in structuring – how does one thematically sort out the 80 maps available? A dual structure was selected which allows for a choice to be operated (via a drop-down menu) according to the region or the theme. The choice of the geographical location could be operated with a simple click on the chosen level (South India, Andhra Pradesh, Karnataka, Kerala, Tamil Nadu). The same principle was applicable for the choice of the theme as well. No matter what the option chosen, it is always possible to switch themes at a specific level or switch levels while studying a particular theme. As regards the difficulty in accessing, it was necessary to enable people using Internet access with a low debit as is the case in India, to consult this site without obtaining the more elaborate maps which are presently available on cartographic servers. The choice was made keeping in mind a lighter version of maps which although precise, were now greatly reduced in size. The format of the images was modelled on the GIF whose features included the possibility of encoding in 256 colours. This reduces the weight of the maps but calls for long phases of experimentation which saw the image conceptualised with the SIG software undergoing several modifications before being ready for online publication. If the quality of the images is poorly in comparison with the habitual Atlas, it is partially compensated by the rapidity in updating and the low cost in accessing.

The result (proposed on the website www.demographie.net/atlas91/) corresponds to the project envisaged: 15 themes clearly illustrate the socio-cultural climate of the 4 South Indian

States at the village and city levels. It is the first cartography of this kind in India although by far not the last.

Conclusions :

We will not hazard any guesses, always a rather dangerous business, on the future of geographic information here. We would instead like to refer the reader to a text forwarded by a former chief scientist with IBM who from 1986, looked ahead into the twenty-first century, inviting him to expand on his vision of the future of geographic information (Branscomb, 1986).

On the other hand, we would like to elaborate one last theory that we have not yet discussed pertaining to scholarly geographic information or online scientific journals. These constitute in fact an interesting alternative to publication on paper and hold out the hope of a breakthrough for the scientific community in the south.

The access to the academic world of science and the exchange of scientific knowledge is undertaken through the medium of peer-reviewed journals. These have a limited number of editions depending on the interested public in question and a distribution that is generally limited to the country of publication, due for the most to the expenses involved in exporting the journal. These constraints, which are specific to paper publication, can be overcome today thanks to online publication (for more details see Lebert, 1999). As regards the scientific journals, the current possibilities and practices are numerous. The format can be incomplete (only a summary) or complete (the entire article is published), either free of charge or for a fee. What is more, this does not rule out the possibility of retaining the version on paper.

The forms are various: paper journals propose summaries of their articles or complete articles for a fee or even with a waiver of fees after a couple of months. It is also possible to find complete online journals free of charge or complete online journals for a fee. Hence, for all disciplines, the website HighWire offers links to a number of scientific journals or more than 1.5 million articles of which almost 600.000 are free. (http://highwire.stanford.edu/lists/freeart.dtl). In the same spirit of things, the server « nap » (http://www.nap.edu/) offers access to online science texts free of cost in the hope that it would motivate the viewer to eventually place an order for a print copy of the entire volume.. A few have also demonstrated the possible financial viability of a free online publication (Walker, 1998).

The potential involved is enormous for all countries in the world. In fact, the move to online publication speeds up the distribution of knowledge, as the processing (essentially

reviewing) is completed in real time thanks to Internet. What is more, it is easier in this instance to obtain feedback on the articles and as proposed by Stevan Harnad, perfectly possible to « flit from peer review to peer commentary » (Harnad, 2000). In the geographic world, the journal Cybergeo (www.cybergeo.presse.fr) was born in the early days of the web in 1996. It prefigures the new forms of online publication. In fact, the articles proposed already partially incorporate the tools ushered in by the new age technology: animated pictures and links with other sources of reference. A dictionary comprising of geographical terms was made available and the announcements of colloquiums were directly linked to the website of the organisers. In fact, a kind of debate is thrown open enabling a public exchange between the researchers. To all this, the journal which professes a European identity, has lent a special touch: the articles can be proposed in the mother tongue of the author. Hence even though French dominates (since the journal is the outcome of the initiative undertaken by a French research centre), we also come across English, Spanish with the possibility of other languages joining the band eventually.

For the countries of the South, the publication represents a unique opportunity to stay in the mainstream of international research despite severe financial crunch. In addition to reading access, the possibility of confronting one's ideas with those of other international researchers, exchanging ideas with translators from different countries is both stimulating and promising. It is also the objective given themselves by the geographers at the University of Cordoba in Colombia when they recently founded their journal Geotropico (www.geotropico.org): they wished to bring together the geographers of the tropical world with the aim of exchanging their views despite the distance that separated them. Once again, here also, the languages are multiple: Latin American dominates, of course, but English also figures prominently.

This could provide the geographers in the Asian continent and especially in the Indian subcontinent with some food for thought. Considering the great many number of journals in India that are struggling to eke out a living despite a shortage of funds and staff, it may not be such a bad idea for these to unite their strengths in order to launch an online journal. Indian geography is richly deserving of this.

To conclude, a reminder of the salient points:

The fresh perspectives opened up by the ICT in the field of the distribution of geographic information are many and varied and these still need to be explored in depth. The present article has attempted to shed light on only a few of the aspects involved but the subject remains too vast to be covered in depth here. It is the reason why we have attempted to base

this study on a bibliography readily available in India or on Internet. This was done with the view to enable the Indian reader to avail of these references. The websites indicated here corroborate our statement and we invite the reader to refer to these.

We cannot help but be aware of the severe limitations still found in this country as in many other countries of the South concerning ready access to online references. The inequalities between the North and the South cannot be ignored in this instance but could be partially reduced if not overcome by an investment in this area. India, it would seem, has understood this need as is evidenced by the leadership potentiality displayed in Bangalore and elsewhere. However, there also remains the general need for education and education for all. It forms perhaps the subject of a different discussion altogether but the subject cannot be dismissed. The problem needs to be tackled simultaneously. And a minimum knowledge of geography must form an essential part of every man's curriculum vitae. As Lewis Branscomb so aptly puts it: « geography is the integrated view of man and his planet, the bringing together of ecology, the study of human habitats, geomorphology, social anthropology, and economics-in short, all the tools necessary to understand how human beings should view their fragile planetary home. » (Branscomb, 1986).

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Cybergeo: http://www.cybergeo.presse.fr/

Notes :

[i] On this matter, see the overview of the conference on “Public Access to Indian Geographical Data” (held on 14–15 July 1999 at the Indian Academy of Sciences, Bangalore) given by R.Ramachandran (2000).

[ii] The most notable is certainly the example of the amercian website geodata.gov which assembles cartographic information for the USA. It describes itself in the following manner : « geodata.gov is a web-based portal for one-stop access to maps, data and other geospatial services that will simplify the ability of all levels of government and citizens to find geospatial data and learn more about geospatial projects underway. »

[iii] On the other hand, a totally Tamil version was not feasible in the absence of a list of localities in the Tamil language. The present lists paradoxically date back the colonial period and no longer correspond to the current group of villages.

[iv] In a country where one still requires more than two days of journey by train to travel from the north to the south, Internet has known stupendous success thanks to its instantaneous e-mail service which rendered direct communication both possible and cheap.

[v] The census was able to provide the first map of India based on the 2001 data only a few months after data collection. This map has been published on paper, and simultaneously on the web. This means that the results were no longer confined to a few people with access to the printed document but globally available at the same time … with no restrictions whatsoever except perhaps non-access to a computer.