PSI IN EUROPEAN METEOROLOGY – AN UNFULFILLED POTENTIAL

R.E.W. Pettifer
General Secretary PRIMET

ABSTRACT

Among all of the possible sources of PSI that can be exploited commercally, meteorological data is one of those potentially most easily accessed, understood and used. All operational meteorological data are exchanged in one or other of a range of internationally agreed and understood formats and almost all of it has a full complement of metadata associated with it. It should be among the easiest of all PSI to exploit for the greater good of the economy as a whole. On the other hand, successful exploitation depends, in many cases, upon access, in near real time, to data sets that span national borders.

Some attempts have been made to deal with these characteristics and to set up arrangements that enable data from most European countries to be made available for commercial exploitation. However, the facts that in each nation there is only one source of supply for the data (the National Meteorological Service, NMHS) and that in many countries these same Services derive some of their core funding from exploiting the same data in the commercial market place, create a distortion in the trading circumstances that restricts the competitive development of the market through wholesale pricing, internal cross subsidisation and restrictions on data supply and its use.

As a result, Europe is annually losing 100's of millions of Euro in net taxation revenues and seeing virtually no significant net growth in the value added end user market in weather products.

This paper will briefly examine some of these issues and identify some of the problems in greater detail.

1. Introduction

The primary characteristic of all Public Sector Information (PSI) is that it is generated directly through the expenditure of public money derived from the taxpayer. It embraces a vast range of material of virtually every type from population censuses and library catalogues through legal rulings to cartographical surveying data from land and sea and, in particular for the purposes of this paper, data generated for the public good by and for the National Meteorological and Hydrological Services (NMHS).

It is important to clarify that the term "data" when used in this context, is not confined to the results of measurements, it is not even necessarily numerical. It also includes processed information in plain language, graphical and other formats. For example the output of computer analysis and modeling that provides zeroth order and first order manipulation of measurements, such as quality control and analysis and the outcome of large scale operations, such as consolidation, data warehousing and statistical computations may all form part of PSI.

All PSI has the economic characteristic that it is essentially non-rival; that is that its use by one user does not diminish its availability or effectiveness for use by others. When it is used, it is not consumed. It is not necessarily, however, non-excludable. The control of PSI is frequently in the hands of a monopoly (public sector) supplier and accordingly access to the data by some potential users can be excluded through a range of mechanisms such as pricing and licensing terms. This makes such PSI what economists call "mixed goods" rather than "public goods" [1] and it is a political choice whether and, if so, how such mixed goods are exploited by those who provide and manage them as a means of recovering income to offset some of the public funds invested in generating them.

2. Meteorological Data

The science and operational practice of meteorology require that the dynamic and thermodynamic state of the atmosphere be known over very large areas (up to the entire globe) in three dimensions at specific points in time and space and that this knowledge be updated at frequent intervals of the order of minutes to hours depending upon the application for which the information is used. In order to meet this requirement national governments have funded and established through their NMHS a global network of observing systems and a complex, dedicated data exchange network utilizing virtually every form of electronic data transmission and which spans the entire globe. On this network all of the data can be very quickly and freely exchanged between all the NMHS and, by agreements reached under the auspices of a UN Agency, The World Meteorological Organisation (WMO), the costs of all this activity within the NMHS lie largely where they fall [2]. There are some exceptions to this, particularly in the case of space based observational data but these are not central to the present arguments.

In addition to the observational data, some large meteorological centres such as the European Centre for Medium Range Weather Forecasts (ECMWF) and certain of the larger NMHS provide numerically based quality control and analysis of all or part of the global data set together with basic, mainly large scale, numerical predictions of the meteorological conditions for periods up to five or ten days ahead.

These observational and numerical prediction data form the raw material from which are derived value added forecast products aimed at specific applications ranging from the local village fête to the operation of an oil drilling rig and including the public tasks of warnings of severe weather on land and at sea.

3. Data Exchange

In order successfully to develop and deliver value added products based upon existing PSI, it is vital that the information is known about and accessible - that it is "discoverable" in the jargon of the subject - and that it is in a format that facilitates its easy exchange, comprehension and use. The vast majority of available PSI does not meet these simply expressed but difficult to achieve requirements. PSI is, in general, in formats, whether numerical, graphical or linguistic, that are particular to the country or even the organisation that generates it. These disparate formats are frequently simply not known to any but those who generated them. Moreover, the location of much of the PSI is also known to or readily accessible by only a very small number of those who may have an interest in obtaining and using it to generate wealth. Its quality is often not known at all. These are formidable problems in the way of the interchange and use of such PSI for the greater benefit of the European (or any other) economy and are some of the underlying imperatives for the creation of the INSPIRE Directive [3].

However, virtually none of the above problems apply to meteorological PSI. Because of the truly international nature of the subject and the overriding need for all data, by whoever it is generated, to be very rapidly exchanged and internationally understood, the data are all formatted into internationally agreed numerical or digital code forms and carry with them the metadata that identifies them and, in many cases their quality too. This makes the subset of meteorological data unique among the total set of PSI and allows in principle the ready exploitation of these data in all countries as the raw material for creating wealth. But it is vital to appreciate that in meteorology, to generate wealth in one nation *requires*, in general, access to the data from many (sometimes all) nations. The issue then becomes how, as a regional or even global community, we exploit the relative economic potential that this situation provides.

4. Exploiting the Knowledge

4.1. The North American Model

As we have remarked, meteorological data is in the nature of mixed goods and it is a political choice how those who control it endeavour to recover some or all of the costs of its generation and distribution. There are two schools of thought. In the USA, Japan and some other jurisdictions all such data, paid for from the public purse, are made available to all at the additional costs associated with their re-distribution. The re-use of the data is usually authorized under the terms of a broad, general license such as that offered by the Canadian Government [4]. Under these arrangements, if a value-adding retailer needs meteorological information that is generated or held by their NMHS such as the US National Weather Service or the Japanese Meteorological Agency, they have a right to access it and it will be delivered at the cost of the communications required to deliver it. In the

present age of the World Wide Web, such costs are, if not trivial, at least commercially acceptable. The PSI holders (PSIH) in these countries do not themselves seek to exploit the data they generate and manage as a source of revenue either through the wholesale market or by operating in the value-added retail market. The data are therefore readily exploitable and there is no question of any conflict of interests between them as suppliers and those who seek the supply and re-use of the data for commercial purposes. The supply of the data in this way is a part of their public task. A contribution to the cost of generating the data is recovered indirectly by the exchequer through the increased taxation of various types that the commercial activity provides.

4.2. The European Model

On the other hand, in Europe, under the provisions of Directive 2003/98/EC [5], the model is quite different. Here, each PSIH has absolute discretion over whether to release PSI for commercial re-use, what terms and conditions shall be imposed upon such re-use and what charges shall be levied by way of a wholesale price for the data. The Directive explicitly states:

- "The decision whether to authorize re-use will lie with the Member States or the public sector body concerned." (Preamble clause 9)
- "Public sector bodies may…impose conditions (on the re-use of PSI)…through a license" (Article 8 1.)
- "Where charges are made, the total income…should not exceed the total costs of collecting, producing, reproducing and disseminating …together with a reasonable return on investment, having due regard to the self-financing requirements of the public sector body concerned…" (Preamble clause 14 and Article 6)

Moreover, in many European countries the political view is that some public sector departments should strive towards "self funding" by recovering directly from the market place as much revenue as possible. To do this, they seek to maximise the income from both the sales and licensing of the PSI that they generate, manage and hold and from value added products derived from this same PSI.

In meteorology this position is reinforced by the provisions of a WMO Resolution [6] that, while enshrining the agreement to exchange freely all meteorological data for the NMHS's own purposes, allows individual member states to place restraints upon the commercial re-use of some such data by third parties.

The immediate consequences of these circumstances are two fold. First, the NMHS in Europe become monopoly wholesale suppliers of raw material (PSI) to the commercial players, usually small and medium sized companies (SMEs), operating in direct competition with the NMHS' own value-adding retail operation. Second, the NMHS may in principle control the competitive activity and the commercial opportunities of their commercial rivals through pricing, licensing and policies relating to the release of some or all of the PSI on which they depend. Such an arrangement is, prime facie, a distortion of what should be a level competitive playing field. In spite of the Directive's entreaties to PSIH to abstain from any such distortions; to levy on their own value-adding ("downstream") operations the same charges and licensing conditions as they impose on their competitors, and to ensure that all such transactions are transparent, it is difficult to avoid at least the suspicion that anti-competitive practices are not entirely absent. Despite that they meet all of the formal legal requirements for publication of accounts, there is virtually no regulation of the

activities of the NMHS and it is impossible to determine from openly published information that their downstream arms are trading completely at "arms length".

The need for the PSIH to protect their own position in the market place and to maximise their net income from the sale and re-use of PSI leads to complex licensing arrangements that are difficult and costly to manage. It also leads to very high prices for some key data that can make its commercial re-use, especially by SMEs, economically impossible in many cases. In the meteorological sector, the sale of data is, for the most part, managed through the economic self-interest grouping known as ECOMET. The NMHS set their own prices and publish the availability and price of the data through an online catalogue maintained by the ECOMET Secretariat. This organisation provides a focus at which interaction between the NMHS and the private sector can be concentrated and has led to some rationalisation and easing of the commercial trading conditions for some of the most widely distributed data. But it does not constrain the NMHS from protecting their own commercial positions either through the setting of wholesale price levels, the consolidation ("packaging") of data for sale or through complex licensing arrangements.

In contrast to the US model within which the supply of PSI to the commercial sector is seen as part of the public task, in the European model, the NMHS frequently see their public task as extending to the provision of value added products to the general public free on the internet. Such products are frequently of doubtful quality but are very professionally packaged and supplied under the powerful, well known and publically trusted brand names of the NMHS. This dumping of product under the guise of serving the public task seriously undermines the opportunities in the commercial market at the low cost end. This is an end of the market that the NMHS cannot serve at affordable end user prices because of their high fixed costs and political mandates but it is where, in principle, there should be potential growth opportunities for the SMEs.

5. The Unfulfilled Potential

5.1. Market Size and Growth

Recent estimates [7] of the size of the 2006 market in value-added meteorological products of all types in the USA and Europe are of the order of $1.4 billion *per annum* and $372 million (€530 million) *per annum* respectively. The respective GDPs of the two areas are similar at $\$11{,}413{,}625 \times 10^6$ for the US and $\$14{,}527{,}140 \times 10^6$ for the EU [8]. Using US estimates of the effect of weather on the economy [9] and very conservative estimates of the benefit/cost ratio that would be necessary to stimulate the market, Pettifer [7] has estimated the size of the available European end user market for weather related services to be in the order of $€2 \times 10^{11}$ *per annum*. It would appear therefore that only about 0.3% of the potential European market in this sector is currently being supplied whereas in the US the equivalent figure is around 7% . Moreover there is evidence [7] to suggest that in real terms, after allowing for growth in GDP, the US market has grown at an average rate of around 17% *per annum* over the past six or seven years while the European market has been growing at closer to 1.2% *per annum* in the same period see Table 1.

Region	GDP $ x 10^6	Potential Market for Meteorological Services $ x 10^{11}	Actual Market $ x 10^9	Actual Annual Tax Revenue $ x 10^6	Potential Annual **Net Additional** Tax Revenue $ x 10^6	Annual Market Growth %
US	11,413,625	2.0	1.4	396	0	17
Europe	14,527,140	2.56	0.372	147	340	1.2

Table 1 The US and European markets for value added meteorological services 2006/07
Sources - IMF, Eurostat, Pettifer 2008**,** Weiss 2002,

This type of difference can be seen in specific market sectors as well as in the overall market. Weiss [10] has pointed out, for example, that in the emerging weather risk management market, the industry is booming in the United States (almost 7,300 million USD in contract value in 3 years ending March 2001) compared to the small European market (120.3 million USD in the same 3 years)

There are, of course, some differences between these two blocs in terms of their economic and social susceptibility to weather and climate and in both the economic structure and level of economic development. But the similarities are likely significantly to outweigh the differences. To at least a first approximation then, it is reasonable to ask why the actual size of the meteorological market is so markedly different between them, and why the market has grown and continues to grow vigorously in the one while it stagnates in the other?

Weiss [10] has argued that this is primarily because of the differences between the two models for the supply of wholesale data that we have outlined above. Although this argument has been challenged anecdotally, there seems to be little, if any, convincing published argument against it. Moreover, it is very difficult to find any clear, credible alternative explanation of why this very large difference in the development and growth rates of the respective markets should exist.

There are other characteristics of the European meteorological market that bear examination and raise questions over the structure and operation of the sector. For example, although the real overall annual market growth in Europe has been languishing below 2% over the past five years, the small part of it (now about 28%) that falls to the private sector has been growing at around 25% *per annum* whereas the 75% that is in the hands of the dominant NMHS has actually declined by around 1.5% *per annum* [7]. This large growth in the private sector component of the market (albeit from a very low base) is doubtless to some extent due to capture of business from the NMHS but the NMHS, despite their greater resources and strong brand positions, appear unable to develop the market and to grow the meteorological economy overall. It is interesting to note that much of this increase in the private sector component of the market has arisen since a few of the NHMS relaxed their PSI supply policies partly or completely towards the US model and made some key meteorological PSI available at the marginal cost of distribution. This suggests that if a major overall structural change in this direction, whether political or commercial, can be made it will encourage the growth of the private sector, stimulate genuine competition and foster the development of the total market.

5.2. Lost Taxation Revenues

The failure to realize the potential in this market place is costing the national treasuries in the EU dearly in terms of lost revenue from taxation. If the European meteorological market were as well penetrated as that of the USA, then the actual market size would be around $1{,}390 \times 10^6$ Euro *per annum*. According to Eurostat [11] the overall taxation return for EU countries in 2005 was 39.6% of GDP. To a first approximation then we might expect that the gross overall tax revenue from this sector would increase by around 340×10^6 Euro. If, to generate this, the NMHS were to lose all of their income from the sale of PSI, and all of their direct value added retail sales (which are assumed to be diverted to the private sector and are thus still within the total market size), then the net benefit to the EU central treasuries from this change in the trading structure of the market would be in the order of 290×10^6 Euro *per annum* and would be, if the US is any guide, growing at about 17% *per annum* in real terms, rather than at about 1.2% *per annum* as they now are.

6. Realizing the Potential

6.1. Changing the Model

6.1.1. Grasping the Nettle

The European model for managing the sale for re-use of PSI arose from the 1970s and 1980s models of public sector management. This, while not challenging the received wisdoms that certain activities undertaken and managed by the State should always be within State control, tried to apply some private sector characteristics to the State enterprises in an attempt to generate revenue from the market place with which to offset the cost burden that the enterprises place upon the central exchequer. But as a competitive external private sector began to develop, the State enterprises perceived both an opportunity to derive income from the sale of PSI and a threat to their retail income stream. It is not surprising therefore that under the political imperatives to which they were subject they appear, to some extent, to have reacted in a protectionist manner, often imposing restrictive licensing conditions, high wholesale charges and in some cases apparently taking advantage of their privileged position as originators and monopoly suppliers of the PSI. The present complex, inefficient and restrictive European trading model and a small, stagnant market are the results. It is this situation that has to change if the market potential is to be realized. But to change requires political will and a degree of entrepreneurial risk on the part of governments.

To adopt the North American model of PSI management without modification might not be the best solution for Europe but a very big step in that direction is required to free up the potential in the European meteorological market and probably that of other sectors also. At least in meteorology, a positive move is required to make PSI available if not at the marginal cost of distribution then at wholesale prices that are determined by a genuinely competitive market. This will require a commercial playing field that is level and that can be seen to be level. To achieve this, the present downstream, value adding retail arms of the NMHS should ideally be completely separated technically and economically from their current relationships with their parent bodies and become, effectively, independent players in the private sector. At the very least, the accounting between these two parts of state owned bodies should be complete, clear and public so that the implication of cross subsidy can be entirely discounted.

6.1.2. The Continuing Role of the State

This is not a call for the complete privatisation of NMHS. In meteorology there are some functions that should properly remain the responsibility of the State. It would be foolhardy, for example, for the State to withdraw from the responsibility for issuing warnings of severe weather that might lead to the loss of life, limb and property. It would not necessarily, however, be foolhardy for the State to obtain the necessary information for this under the provisions of a contract with a particular private sector supplier. Even the fulfillment of the national obligations to gather, process and distribute the observational and processed data that we described earlier could, in principle, be the basis of contracts between the State and the private sector. The provision of the (essentially financial) contributions to large co-operative international ventures such as ECMWF and the European satellite projects on the other hand, could not. Issues of national defence may also be more sensitive and less easy to manage securely on a contractual basis with the private sector but such a decision is a matter of political rather than commercial judgement.

Whatever system is used, however, for the generation and dissemination of PSI there are two fundamental responsibilities that fall to the State. The first is the clear definition of the "public task" such that it precludes the anti-competitive "dumping" of value added products on to the market place, and the implementation of arrangements to fulfill it within the sector. The other is to establish and to maintain clear, effective and fair regulation of quality within the market place, both for the PSI itself and for those who wish to operate within the value-adding retail sector. There is nothing unusual about such arrangements. They are already widely implemented, one way or another, in a range of professions and market sectors such as medicine, the law, energy supply and telecommunications. While the principle of *caveat emptor* may have a greater role to play in some sectors than in others, the case for some level of regulation in a sector such as meteorology is strong.

7. Conclusions

As the result of both the disparate political structure and the national political decisions made in the 1970s and 1980s, the present EU value added retail market in meteorology is underperforming by about a factor of 3 with the resultant net loss to the central exchequers of some 300×10^6 Euro annually in taxation revenue. Moreover the market is growing overall at an annual rate that is about 14 times slower than the comparable market in the USA. The major first order difference between the structure of these two markets lies in the way in which the "public task" is defined and the way in which, as a result, PSI is made available by public bodies, in particular the NMHS, to the value adding commercial sector.

Although this analysis, originally proposed by Weiss in 2002 [10] and subsequently strengthened and substantiated in the published literature, has been challenged informally, there appears so far to have been no argument published, nor any formal analysis advanced that refutes Weiss' claim. Moreover, there seems to be no other market difference that is *prime facie* significant enough to lead to these very large differences in market performance.

To exploit the potential of the European value-added meteorological market the European PSI trading model in this sector needs radical revision. Only if this political nettle is grasped will the full benefit from the huge investments that are made in generating PSI in meteorology be realized and the objectives enshrined in Directive 2003/98/EC [5] of stimulating in Europe, and benefiting from, a vibrant knowledge economy, be achieved in the meteorological sector.

8. References

1	Freebairn John W and W Zillman John 2002	Funding Meteorological Services. Meteorol. Appl **9**, 45-54
2	Donker Ton W 2007	Access to and re-use of Public-sector Environmental data and Information. Policy Developments with a Focus on the European Hydro-Meteorolgical Scene. Polish Academy of Sciences Geopgraphica Polonica Vol **80** No 2
3	European Commission 2007	Establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) Directive 2007/2/EC March 2007.
4	Natural Resources Canada 2008	Geogratis Licence Agreement for the unrestricted use of digital data 2008 http://www.geogratis.ca/geogratis/en/licence.jsp;jsessionid=5F71CEF56A683086A8E577BB1768A635
5	The European Commission 2003	Directive 2003/98/EC of the European Parliament and of the Council of 17th November 2003 0n the re-use of public sector information. Official Journal of the European Union 31.12.2003 L345/90-96
6	World Meteorological Organisation 1995	Resolution 40—WMO policy and practice for the exchange of meteorological and related data and products including guidelines on relationships in commercial meteorological activities. Twelfth World Meteorological Congress
7	Pettifer R.E. W. 2008	Towards a Stronger European Market in Applied Meteorology. Meteorol. Appl. **15** 305-312
8	International Monetary Fund 2007	World Economic Outlook Database
9	Board on Earth Sciences and Resources	Fair Weather. Effective Partnerships in Weather and Climate Services. Report of the Committee on Partnerships in Weather and Climate Services and the Committee on Geophysical and Environmental Data. National Academies Press Washington DC ISBN-10: 0-309-08746-5 2003
10	Weiss P. 2002	Borders in Cyberspace: Conflicting Public Sector Information Policies and their Economic Impacts U. S. Department of Commerce National Oceanic and Atmospheric Administration National Weather Service February 2002
11	Eurostat 2007	Eurostat News Release 89/2007 26th June 2007