European Space Policy Institute

Networked Space!

The rate of innovation and discovery in a society is a function of the degree of access to data. Not a linear function, for sure, but the notion that the lone genius in splendid isolation will be the author of groundbreaking discovery and technological breakthrough is increasingly being disowned by the information society, where data and ideas are being shared at breathtaking pace. Own observation of nature or society can still lead to revolutionary ideas, yet the fuel of new thought is often digestion of new data collected by others and the effortless exchange of ideas with peers from same or other disciplines. Plato's Academy was the early manifestation of this reality, but the rise of the internet and new technologies allow our society to draw on the creativity of many more players, allow us access to much more information, and allow rapid-fire, highly efficient exchange of data and ideas. We can all be members of the Academy! This realization has been the genesis of the phenomenon which can be coarsely described as collective intelligence. Many interesting books are written on this topic and MIT even has a Center on Collective Intelligence. The Human Genome Project is normally seen as the poster-project on collective intelligence, although many developments in this field have taken place since this project started.

For the purposes of this brief overview, one can perhaps say that collective intelligence turns on two distinct, yet inter-connected approaches, the first being the open access to data, and the second being participatory innovation.

In space science there is very good compliance with the open access principle. Given how the speed of society is ever increasing one can perhaps debate the duration of exclusive data access for scientists in some missions, but generally speaking the space science community is well within the parameters defined by OECD in 2009 for open access to publicly funded research data. The Sloan Digital Sky Survey (SDSS) is a marvellous tool for professionals and amateurs alike. And talking of amateurs one should also tip the hat to the space science community for having come up with participatory approaches like GalaxyZoo, MoonZoo etc.. The normal interested citizen is being given the opportunity to contribute to state-of-the- art space science through initiatives like this. Citizens are asked to look at the immense wealth of the SDSS and categorise galaxies according to criteria which are easy to understand and apply; all on-line, of course. More than 200.000 people have become involved, and by becoming involved they do space science a great service, since the 930.000 galaxies contained in the SDSS cannot be categorised in any reasonable time by space science professionals only, and since human beings (hooray) are still better at categorising this sort of phenomenon than computers. The result of popular engagement: much faster discovery and interesting breakthroughs such as the discovery of green pea galaxies and the Voorwerp. There is no reason to be complacent, however. Much more can be achieved considering the readiness of the population to buy-in. The active involvement of citizens in identifying comets with the help of SOHO has been encouraging, yet a more incentivising approach, with more tools made available to citizens, a la GalaxyZoo, might bring even more benefit, and if one looks at the whole swath of space science data surely participatory science can be encouraged more and our collective

intelligence be tapped even more effectively. Many organisations have technology transfer offices; perhaps more organisations should also have citizen science offices, that is, offices which dream up new ways of involving citizens in front-line discovery, not just educating citizens on the fantastic discoveries already made. By this, incidentally, the public support for space science funding would also be further shored up.

The OECD guidelines on open access to publicly funded research data can be argued to not apply to all the purely technical data generated through public funding in the space field. Yet, with public funding goes the obligation for policy makers to make sure that the public has the greatest possible benefit of its investments. This then raises the same questions on open access and participatory discovery and innovation as space science data did. The possible constraining factor is the inevitable commercial interest in technical data, but there is a real question mark on whether the situation is ultimately different than for research data. What we as a society must want is more innovation, faster innovation and the avoidance of overlap of data generation to the extent possible. In the past the patent system served to balance the need for protection for inventors with the need for society to continue innovating using also the patent-protected, but published, data. This system has not outlived its utility, as evidenced by the large number of patents issued every year. Still, the reality is that a lot of the most innovation-auspicious data will never get to the public arena, since reliance is had on confidentiality and hence patents are not sought and perhaps not even available. This is true both for privately and for publicly funded data, where for the latter, bizarrely, there might be a tendency to patent-protect less because patents often confer wider utilization rights on the funding authority than if the data is only considered 'commercially confidential'.

Assuming for a moment that there might be good reasons to allow companies to keep to themselves commercially interesting data paid for by the public, it is still noticeable that in the space field, as in most other fields, there is little effort made to distinguish between the data that is truly commercially important, and the data which might just help others avoid duplicating the data-generation effort or might allow companies in other businesses to utilize the data for completely different applications. The lack of a 'knowledge commons' for technical data which is useful to others, but not embodying great creativity or bestowing a significant commercial lead, is a driver of inefficiency and an obstacle for cross-fertilizing innovation! When the funding for producing the data is public there is as much reason for public authorities to insist on open access to this sort of data as there is for insisting on open access to space science data.

A fundamental question is still, of course, whether companies should have any ownership rights or exclusivity rights at all to data which they have been fully paid for to generate. The commercial argument will often be that, in reality, the public does not fully fund the data, simply because the data is generated by the use of expertise and infrastructures which have been established by the companies over a long period of time and under their own funding. This argument is for many reasons tenuous, particularly when one considers what the public benefit could be of open access. Yet, there is a kernel of truth, and society must be careful not to introduce systems which might actively discourage creativity in publicly funded R&D work. This does not go to say that the absoluteness of the current system must be retained, however. In space science there is a period of exclusive use of the data for the institutions which have funded the experiment or instrument of typically two years, and this sort of approach could be emulated for technical data, although the period of exclusivity might have to be longer there, say, five or ten years. But why exclude publicly funded technical data forever from the knowledge commons we must build to foster more and faster innovation? The argument against this to the effect that by creating a global knowledge commons governments are helping low cost producers sidestep development cost is not convincing if the period of exclusivity is defined appropriately. The public's justified question will be why it should wait even longer for inventions and innovation, if the company sitting on the data has not been able to commercialize the possible products, or create a considerable commercial lead, even if it has

been given a five or ten years head-start.

Still, open access to data is only one part of the equation. The other part is participatory innovation, and here there are even more untapped resources than in space science. Domains such as InnoCentive, an online marketplace for science and technological solutions, have shown how much can be achieved by bringing the right person to the right data by structured internet based approaches. Furthermore there is a wealth of micro-specialists out there, specialists on extremely narrow topics. A lot can be achieved by applying their expertise to diverse small parts of a much bigger problem, the trick being to ask the right questions and ensure that ultimately the multitude of micro-specialist answers can be drawn together to provide an overall better answer than the one that could be achieved by asking the world's biggest expert..

All this is a potential rich source for space projects, for which it could be considered to put particularly vexing technological issues to the public for participatory solution via the internet early in the development process. But also, it might be a good idea to have one public early phase study in parallel to the two competitive commercial early phase studies which are habitually performed for space segment developments. It would be likely that the public early phase study would often be more innovative, and perhaps even better than the commercial ones. And such public, private competition might also set the scene for new structures for performing the subsequent phases, keeping in mind that unsuccessful bidders for the commercial early phase studies might well bring their expertise to the public early phase studies in an attempt to get a second bite of the cherry.

In sum, there are good reasons to have a fresh look at the methodologies that have been used in the space field for decades, simply because well-educated populations now, thanks to the internet, can bring their collective intelligence to bear on problems that were difficult or impossible to solve with the resources deployed in the un-networked past!

If you would like to dig deeper in the field of innovation please see, for instance, ESPI Report 9, Stimulating and Sustaining Technology Innovation in the Space Sector, ESPI Report 11, Isolation of Space Research from Space Industry. How to Improve the Relationship between Broader Basic Science and the Space Industry, ESPI Report 24, Key Enabling Technologies and Open Innovation. New Impulse for the Space Sector, and our upcoming reports on this topic foreseen for February and August, 2012.

A very good book on innovation in the time of the internet is Michael Nielsen, Reinventing Discovery, Princeton University Press, 2011.

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