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# Research Information Management System (KRIMSON) at Kent

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## Abstract

This paper is a case study describing the implementation of an integrated research information system (CRIS), using the Converis v5 system, at the University of Kent, branded locally as KRIMSON – Kent Research and Innovation System Online. It reflects on the lessons learned for the implementation as a whole, and, in particular, the experiences with the various integrations and interfaces that were developed to other existing University IT systems: user authentication, HR, Finance, Institutional Repository, and the, student records system.

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*Keywords:* CERIF, KRIMSON, Integration, Interoperability, Project Management, Research Administration, Research Information

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## 1. Introduction

This paper outlines the implementation of the Current Research Information System (CRIS) aka KRIMSON<sup>1</sup> at the University of Kent, and reflects on the insights gained and lessons learnt. It focusses on system interoperability and interface issues. KRIMSON is envisaged as a cradle-to-grave research information management system, as defined by Binge<sup>2</sup> and elucidated by Fairly et al.<sup>3</sup> and Wang et al.<sup>4</sup>, albeit using standard integrations rather than an enterprise service bus that they describe, with functionality for pre-award proposal tracking and approval, costing and pricing, post-award management and financial reporting, publications management, activities and event records,

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research student supervision, and an on-line “mini-CV”. To date not all of this functionality has been satisfactorily achieved. This paper will explore some of the issues that have contributed to the sub-optimal situation and provide practical advice for those undertaking a similar project; in a number of ways our findings are similar to those of Siciliano et al<sup>5</sup>. The overall aims are to reduce administrative and academic burden and to provide better analytics on research for reporting, planning, and strategic functions such as submission to the UK Research Excellence Framework, as described for example by Pidd and Broadbent<sup>6</sup>.

## 2. Context

Whilst KRIMSON is an integrated system, it must also exchange information with a number of existing university systems, as outlined in fig.1 KRIMSON Context Diagram. This also shows the planned phased roll-out of the system.

### KRIMSON Context Diagram

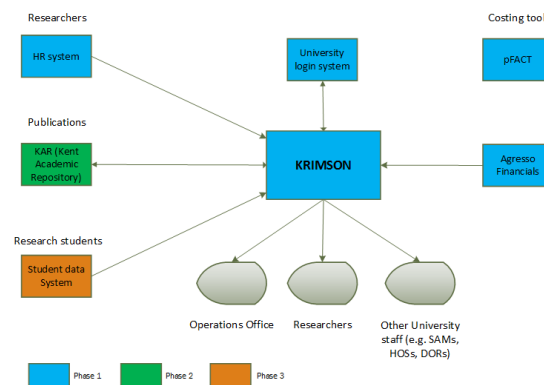


Fig. 1. KRIMSON Context Diagram

KRIMSON (Kent Research and Innovation Management System On-line) is the local branding for a modular off-the-shelf system, Converis<sup>†</sup>, see also Jägerhorn<sup>7</sup>, from Thomson Reuters. Our implementation consists of five integrated modules: Pre- & Post-Award Management, Publications Management, Research Analytics, Research Portal, and Converis Configuration, which all work well together and have caused no particular issues in terms of problems with implementation. Rather than managing the system within the University, we opted for the off-site hosted option.

## 3. Project Management

The original plan was for a project manager to implement a CRIS over a two year period. The project manager started in February 2013, with procurement planned for the summer. Following the procurement, the project plan was developed in conjunction with the Supplier, Avedas<sup>‡</sup>, with implementation and configuration during the latter part of 2013, testing scheduled for Jan 2014, with a go-live of phase 1 in April 2014, followed by phases 2 and 3 in the summer and autumn of 2014 and, finally, six months of bedding-in and transition to “business as usual”. Phase 1 was research project management (pre- and post- award), phase 2 added Publications (and other forms for research output) management, and the final phase 3 added other research interests and activities. The period after procurement to initial testing ran relatively smoothly and to schedule. However, towards the end of the phase 1 implementation and configuration, the software vendor, Avedas, a small German company, was taken over by a much larger multinational

<sup>†</sup> <http://converis.thomsonreuters.com/>

<sup>‡</sup> <http://ip-science.thomsonreuters.com/avedas/> Avedas was purchased by Thomson Reuters in Dec 2013

company, Thomson Reuters. Initially this coincided with the planned three month testing period and so there was no impact on the project plan. However, in April 2014 and the following few months, it became clear that the company's, originally very responsive, project manager was not delivering the required changes in a timely manner.



Fig. 2. Initial Project Timeline

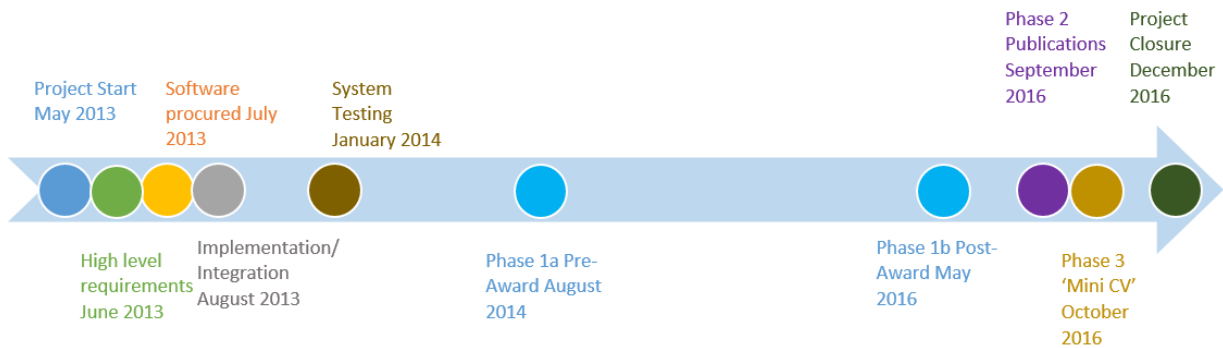


Fig. 3. Current Project Timeline

For personal reasons the Kent KRIMSON Project Manager left his job at very short notice, just before the go-live date. At more or less the same time, the Supplier's project manager also left his post. This rendered the project severely under-resourced at an extremely critical time. Both newly appointed managers had to get up to speed quickly. This caused the project a minimum of two to three months' delay. At the same time, the Supplier increased their customer base by 50%. However, the Supplier's development staff base remained static. Delays were inevitable. In September 2015, another Supplier project manager was assigned to the University of Kent. The benefit of having a new manager meant that, in order to create a good impression, they were eager to complete Kent's project as quickly as possible. The disadvantage of yet another a new manager was that they were not familiar with the system and Kent's configurations, which inevitably led to misunderstandings and uncertainty over objectives. As a result, a dedicated resource was assigned to the Kent project in order complete all outstanding integrations by Christmas 2015; crucially this included an extended on-site visit at Kent for both the Supplier project manager and the technical expert. This was essential and a huge amount of progress was made. At all times the relationship between the University and Supplier benefited from open and frank conversations about timescales and expectations. Other than the project management issues outlined above, the main causes of delays were the integrations, or interfaces, with other existing University systems, and they will be the focus of the paper.

#### 4. Interoperability: Benefits and Pitfalls

##### 4.1 Current University systems that have been integrated with KRIMSON

One of the main advantages of a system like Converis is that it supports the "enter once, reuse often" mantra as espoused in the research information management arena by Jeffery et al<sup>8</sup>. Not only is the system built on the

international CERIF standard<sup>9</sup> for research information, it is also extensible, being able to export information to, and import information from, other systems. There are numerous legacy systems KRIMSON benefited from integrating with: User Authentication (Shibboleth<sup>10</sup>), Human Resources (PSE<sup>11</sup>), Financial system (Agresso<sup>12</sup>), Kent Academic Repository (EPrints<sup>13</sup>), Student Data System (SDS<sup>14</sup>, an in house system), and Costing and Pricing system (pFact<sup>15</sup>). Each of these will be considered in turn.

**User Authentication (Shibboleth)** - Kent uses a federated user account access management system, meaning that, the end user can use a single user id and password to access that software. **Benefit** - University staff can take advantage of a single-sign-on (SSO) mechanism which enables them to use their university login information on the remote system. University staff members do not need to create and remember a new user name and password. **Pitfall** - no major pitfalls were experienced. The requirements were clear, the Supplier had performed this integration before many times. There was a worry that an additional click (to confirm that the user is passing to an external system) would put users off, but no adverse feedback was received. **Lesson learnt** – it is important to have clear requirements which are followed through. Making user's lives simpler it is always worth striving for.

**HR system (PSE)** - The HR (Personnel) database holds information on all staff at the University. All research is associated with people (generally staff, but sometimes with students, see SDS below), and hence this entity is a core part of the KRIMSON system. Without this integration, information on staff would have to be maintained separately, which would be a huge burden. **Benefit** - all new staff members who are added in to the HR database will have appropriate information (name, academic school, etc.) automatically imported into the system. Updated information for existing staff is automatically imported into the system. Imports occur at night, which means that if system performance drops, it will not affect end users. **Pitfall** - after rolling out the first module, 'the pre-award management', it became evident that the database schema could not deal with staff who changed their organisation on the same contracts. This had a negative impact on their permissions. The compound of the unique key had to be updated. The cost, time and effort spent on fixing this issue could have been spent on other outstanding issues that needed addressing. **Lesson learnt** - pay attention to system administrations. Utilise the experience of the staff who currently use the existing systems. Obtain 'requirement determinations' by the experienced staff. Test as all possible scenarios. Testing cannot be too excessive. **Miscommunications, Unclear/ambiguous requirements**

**Financial system (Agresso)** - The Agresso system is a comprehensive finance system that manages the entire finances of the University. One module, Project Costing and Billing (PCB), is used to manage the finances of externally-funded projects, most of these are either research or innovation projects and hence of interest to KRIMSON. Importing information from Agresso not only allows researchers to quickly see the financial status of their projects, it also allows for the sophisticated forecasting of future income by managers, particularly when combined with project proposal information and average success rates. **Benefit** - this integration allows the periodic import of budgets with actual costs and commitments. This provides staff with a quick overview of their project spend against budget, without having to master the finance system. **Pitfall** - in its current configuration the system does not cope with daily transaction imports. Too many transactions could reduce the system performance and make it unusable. The periodic import was suggested as a workaround, but is not granular enough; it does not add any value to users over and above the monthly reports that they receive from the Agresso system. It appears that this is an area where a redesign could provide the initially envisaged functionality. Information on commitments were originally omitted from the monthly import, due to a misunderstanding/insufficiently precise requirements. **Lesson learnt** - again, not enough attention was paid to exactly what the end users wanted from the system. They used "lay" terminology, which was then misinterpreted by others. Even though requirements were gathered through a numerous number of meetings, many of the specified elements were left out. They were either omitted or regarded (by the Supplier) as 'not possible' at that time. **Miscommunications, Lack of a shared vision, Unclear/ambiguous requirements**

**Kent Academic Repository KAR (EPrints)** - *still in process of integration* - KAR is an EPrints based Institutional Repository which holds metadata on over 40,000 research output records (mainly relating to journal articles and books) from Kent staff and students, and the full text for a subset of nearly 8,000, i.e. just under 20%. For various

reasons, see for example Mintrom<sup>16</sup>, including the REF, it is important that the University knows what the academic output of its staff is. Further, it is increasingly becoming important, for example for reporting to research funders through systems such as Researchfish, see Viney<sup>17</sup> that outputs can be attributed to which funded projects. Hence, it is important to develop functionality to be able to link research outputs to staff, and projects. **Benefit** – the end user will be able to populate KAR through, and interface with, enhanced functionality (e.g. import from ORCID, see de Castro and Warner<sup>18</sup>). In addition, outputs can be linked to projects. **Pitfall** – this was the first integration between Converis and EPrints. After much misunderstanding between the Supplier, the University, and EPrints, it transpired that the Sword2 protocol API had only been partially implemented in EPrints. This resulted in further delays, disputes and frustrations. **Lesson learnt** – the Converis system, at the development level, had to be adjusted throughout the integration as this was the first integration between Converis and EPrints. The lack of understanding from both sides resulted in delays. A clear understanding of the integration from the development point of view should have been presented to Kent. This might have led Kent to ask the right questions and avoid disappointments. **Unclear/ambiguous requirements, Miscommunications, Technical issues**

**Student Data System** - Data from the student system provides additional information on staff, such as the research students that they supervise and the modules that they teach, a possible proxy for their research interests. The imported information is to be used to create a more rounded and complete mini-CV. It should be noted that this integration has not yet been fully tested. **Expected Benefit** – an automated mini-CV for research staff, kept up to date with no additional information being needed from staff

**pFACT** - This is a stand-alone costing and pricing system used in the preparation of project proposals.

**Expected Benefit** costing and pricing is integrated into the KRIMSON, reducing the re-keying of information.

#### 4.2 KRIMSON modules

**Pre-award management** - This module has replaced the paper based copy for Kent's internal approval process while applying for external funding. This is also the only module, which is fully implemented and rolled out University-wide. There are on average four research applications created each day. **Benefits** - it is a web-based system as opposed to a paper-based system, and therefore end users are not required to be onsite while creating or approving grant applications. The internal approval process is now faster. Replacing the paper based system has led to a **50% reduction** in the time spent on approving grant applications without adding extra resources. A single application is being approved within 1-2 days in KRIMSON as opposed to 4-5 days through the paper based system. (The previous paper approval system required circulation between various offices/Schools before University approval was reached and an application was submitted for external funding). **Re-usability** - the information within the application can also be re-used in the other management-modules, which means less time is invested in re-typing key information of particular projects. Also, the system has a project application cloning function which saves researchers considerable time and effort when developing similar proposals (perhaps to different funders). **Accessibility** - all relevant documents are saved in the Document section. **Transparency** - all staff linked to particular applications can now see what actions have been performed at each stage and the status of each application, throughout the entire process with access to all documents as and when needed. **Pitfall** - there is currently no data validation module. The system is heavily reliant on end user's experience, intuition or luck. The data validation module was on the Supplier roadmap list in 2014 but has never been delivered. **Lesson learnt** - not having data validation module in place means that additional resource for an ongoing end user support was required. This added approximately 8 hours a week of effort within Research Services. **Usability, Academic buy-in, Perception/Reputation of KRIMSON internally**

**Post-award management** - As already discussed above, the 'Costing and Pricing' module is used to manage the finances of externally funded projects. This module is yet to be developed in Converis. Until then, items such as forecasting of future incomes will need to be done outside of KRIMSON. Furthermore, Research Services (RS) and Kent Innovation and Enterprise (KIE) departments had expected the post-award management module to produce 'announcement sheets' for Principal Investigators. This was expected to happen automatically once projects were granted and were ready to be announced. The current process is driven manually although it uses dynamic templates

depending on the project or the funder. Although time has been invested developing this new functionality, it was decided that ‘announcement sheets’ would only be generated through ‘report development’ using Pentaho.

**Expected Benefit** - a ‘quick overview’ or summary of project financial information will be available to staff who will not need to master Agresso (the finance system). **Pitfall** - the import from Agresso is only once a month (on the 14<sup>th</sup> of each month) and therefore the report summary will only be truly useful on that day of each month. Reports such as ‘announcement sheets’ are required to be developed using Converis 3<sup>rd</sup> party Pentaho. Since Converis is hosted by a third party supplier, Kent does not have access to this server which adds extra time and cost to the project. **Lesson learnt** - it would have been beneficial if real case scenarios had been presented to Kent before integrating this module. The post-award functionality was a mainly bespoke configuration and could not be easily adapted to our processes without implementing workarounds. **Unclear/ambiguous requirements, Technical issues, Miscommunications, Lack of a shared vision**

**Publication management - still in process of integration** - The publication management which we purchased and modified will enable staff to collect records and attachments. In order for the data that is collected to be transferred from Converis to EPrints such that, identified records and file attributes will be pushed into KAR. KAR allows external access to publications. **Expected Benefit** - as already stated in point above Converis is integrated with other external sources such as ORCID and Web of Science. As such, existing publications can be automatically imported into KRIMSON. **Pitfall** - Converis is not fully compatible with EPrints. A number of workarounds had to be employed in order to make collect the data and transfer into KAR. This would not be an issue if KRIMSON was used as a standalone system. **Lesson learnt** - it was invaluable to have the Supplier’s developer onsite. Within a few days a number of outstanding issues regarding record information were resolved. **Technical issues and Miscommunications**

**Mini CV (Converis Research Portal) - still in process of integration** - Thomson Reuters offer ‘Website services’, which enables research information to be publicly displayed over the web. A ‘mini-CV’ template is to be developed via Pentaho Reporting Developer tool which will collect and transfer data to the various academic schools’ web pages. **Expected Benefit** – Research data from KRIMSON will be automatically linked to webpages, ensuring consistency in the display/style across schools/departments.

### 4.3 Other

**Servers – both systems are on the same server** - Another notable misunderstanding between the Supplier and the University happened during the procurement phase. The University’s project manager automatically assumed that the ‘live’ environment would have been mirrored by a ‘test’ environment, both of which would be provided under one contract. After negotiations a test environment was provided free of charge, however it did not include support and system upgrades for this environment. It came to light quite by chance that the test environment was hosted on the same server as the live environment. This offered little or no redundancy in the event of server failure during development or when implementing upgrades. On the upside, test and live environments existed as separate logical instances of a server and therefore high level process failures had no communal effect. **Benefit** - there is no benefit having both environments on the same server other than that it is more economical. **Pitfalls** – when the physical server is down, both systems are down. Both environments shared the same physical memory and therefore the live system slows down when load is placed on the test system. **Lesson learnt** – it should not have been assumed that the Supplier shared our belief that the test environment would be decoupled from the live environment. Further, for the sake of redundancy, they should ideally be physically separate or at least bona fide ‘virtual servers’. **Unclear/ambiguous requirements, Technical issues, Miscommunications, Lack of a shared vision**

**VPN connection between Kent and the Supplier** - The Virtual Private Network (VPN) connection was initially set up to allow access from four systems; ‘HR’, ‘Financial’, ‘SDS’ and ‘User login’. However, requesting VPN access from other local systems was complicated by the fact that too small an IP subnet had been assigned by Thompson Reuters. Access from additional systems was only made possible by assigning a new address range which meant changing existing IP addresses. **Benefit** - data transferred between our systems and KRIMSON is secure. **Pitfalls** - the initial set up restricted integration from other systems. This required setting up a new IP address via a

proxy server and reconfiguring both ends of the tunnel. The time and effort spent on this could have been invested in other areas. This could be seen as short sightedness by not assigning a big enough address range or it could be seen as delivering the exact requirement (with no room for growth). Whichever way, it caused more work and effort. However, there are no pitfalls with this current setup. **Lesson learnt** - gather advice from local network administrators prior to agreeing requirements. It would have been beneficial for everyone if the expert's opinion had been listened to. **Technical issues, Lack of a shared vision**

**Hosting** - The full system integration was expected to be completed within twenty-four months. Therefore, the University opted for a hosted system. This required less time and effort from the Information Services staff and it was also cheaper. **Benefit** - faults, maintenance and support are dealt with by the Supplier within agreed time limits. **Pitfalls** - we have no access to the server, which causes issue while developing reports in Pentaho (see below). **Lesson learnt** - a contingency plan could have been in place in the event that they were not able to provide the hosting within specified timescales, perhaps using financial penalties as a lever to ensure requirements are met. **Lack of a shared vision**

**Reporting using Pentaho tools** - Converis is integrated with an open source Pentaho reporting suite. It is hoped that enhanced reports will be developed and linked to various user roles within KRIMSON. **Expected Benefit** – reports will be attached to various user roles within KRIMSON. This will provide a quick and efficient way of viewing research information on grants, projects and publications. **Pitfalls** – Reports were planned to be developed within the project scope. There was not clear understanding how these reports will be developed and subsequently maintained in KRIMSON. ‘Research analytics’ were set up only for the pre-award management (phase 1a) functionality. Also, when reports are to be added to users in KRIMSON, an access to the server is required. Since KRIMSON is hosted by a 3<sup>rd</sup> party, this has proved to be problematic, not economical and time-consuming. **Lesson learnt** – All hidden costs, e.g. ‘Consultation fees’ need to be addressed when they occur, and ideally beforehand. **Unclear/ambiguous requirements, Technical issues, Miscommunications**

## 5. Conclusions

The project was severely hampered by personnel changes at both the University and the Supplier. These issues cannot really be planned for. The Supplier staff changes were probably due in the main to the change in ethos and priorities and working conditions, meaning that existing staff from the smaller company that had been bought-out were not inclined to stay. Neither of these issues (family circumstances, corporate take-over) could have been ameliorated. This perhaps falls into the category of “bad luck”. This uncertain position then led to delays, and to a certain extent, a loss of “corporate memory” on both sides. There were long delays with new staff, on both sides, but mainly at the Supplier, getting up to speed with the project. There were also some Supplier side issues in terms of resources availability and changed priorities in development schedules – for example there was no functional development for a few months while the underlying database system was migrated to the new Supplier standard.

The key issues here are communication and trust, which took some time to rebuild, with new personnel on each side. It became clear that the original timescales would not be kept, but an open dialogue and willingness of both parties to make the project work resulted in various agreements to keep the project within budget, notwithstanding the additional effort being required from both sides, particularly the Supplier. A good working relationship with people at the right level is crucial. In summary, the project has had a long, and at times, painful gestation. It is only through the commitment of both the University and Supplier staff to work together that it is nearly at fruition. The overall aim of greater efficiency of process in managing research projects, outputs and academic CVs is now in sight; and the power of having research information data to hand can soon be realised. Our experience has been very similar to that of Siciliano et al. [4] Perhaps the most important characteristics of a project manager are diplomacy, integrity, communication, trust, and doggedness.

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## Appendix A.

Table 1. Summary of all Lesson learnt categories for each system or module.

Phases	System/Module	Unclear/ ambiguous	Miscommu- nication	Lack of shared vision	Technical issues	Usability	Academics buy-in	Perception/ Reputation
Phase 1a Pre-Award	User Authentication							
	HR system							
	Pre-Award module							
Phase 1b Post-Award	Financial system							
	Post-Award module							
Phase 2 Publications	Kent Academic Repository							still in process of integration
	Publications module							
Phase 3 Mini CV	Student data system							
	Mini CV							still in process of integration
Other	VPN							
	Hosting							
	Two systems/same server Reporting							still in process of integration

## 6. References

1. KRIMSON <https://www.kent.ac.uk/researchservices/krimson/> Website, University of Kent. Accessed 5<sup>th</sup> May 2016.
2. Binge A. Research Management and Administration System – feasibility study part 1, University of Exeter; 2009. Available online at: <http://www.exeter.ac.uk/research/rmas/about/keydocuments/> accessed on 21st February 2012.
3. Fairley P, Ginty K, Kerridge S, Foster S, Trowell S, Hustwayte S, Butcher S, Brown S, Major R. RMAS – Delivering an integrated Research Management & Administration System, CRIS2012, 2012, 6-9 June, Prague. Available online at: [http://www.cit.sunderland.ac.uk/downloads/files/CRIS2012\\_21\\_full\\_paper.pdf](http://www.cit.sunderland.ac.uk/downloads/files/CRIS2012_21_full_paper.pdf) accessed on 4th May 2016.
4. Wang Y, Kerridge S, Smith P, Foster S, Coppin S, Trowell, S. Integration of CERIF, ESB and Cloud in the Development of a National Global Research Administrative Management System. *Metadata and Semantic Research*. 2011. Springer, pp. 245-255. ISBN 9783642247309. doi:10.1007/978-3-642-24731-6\_26.
5. Siciliano L, Schmidt S, Kinzler K, BoRIS and BIA: CRIS and Institutional Repository integration at the Free University of Bozen-Bolzano, CRIS2014, 2014, 13-15 May, Rome. Available online at: [http://dspacecris.eurocris.org/bitstream/11366/210/1/14\\_Siciliano\\_Schmidt\\_Kinzler\\_CRIS2014\\_Rome.pdf](http://dspacecris.eurocris.org/bitstream/11366/210/1/14_Siciliano_Schmidt_Kinzler_CRIS2014_Rome.pdf) accessed on 5th May 2016.
6. Pidd M, Broadbent J. Business and Management Studies in the 2014 Research Excellence Framework. *British Journal of Management*, 2015, 26: 569–581. doi: 10.1111/1467-8551.12122
7. Jägerhorn M. Interoperability: the View from Converis, EuroCRIS Strategic Membership Meeting Autumn 2014, 11-12 Nov, Amsterdam. Available online at: [http://dspacecris.eurocris.org/bitstream/11366/363/1/Interoperability\\_CONVERIS\\_view\\_J%C3%A4gerhorn\\_euroCRIS\\_SMM\\_Amsterdam\\_2014.pdf](http://dspacecris.eurocris.org/bitstream/11366/363/1/Interoperability_CONVERIS_view_J%C3%A4gerhorn_euroCRIS_SMM_Amsterdam_2014.pdf) accessed on 5<sup>th</sup> May 2016.
8. Jeffery K, Houssos N, Jörg B, Asserson A. Research information management: the CERIF approach, *Int. J. Metadata, Semantics and Ontologies*, 2014, Vol. 9, No. 1, pp.5–14. Available online at: <http://www.inderscienceonline.com/doi/pdf/10.1504/IJMSO.2014.059142> accessed 5th May 2016.
9. CERIF 1.6 Release by euroCRIS, August 2013. Available on-line at <http://www.eurocris.org/cerif/feature-tour/cerif-16> accessed 5th May 2016.
10. Shibboleth <https://shibboleth.net/> Website, 2016, accessed 5<sup>th</sup> May 2016.
11. PSE <http://www.ngahr.co.uk/> Website, 2016, accessed 5<sup>th</sup> May 2016.
12. Agresso <http://www.unit4.com/uki/applications/cfo/business-world-financials/> Website, 2016, accessed 5<sup>th</sup> May 2016.
13. EPrints, <http://www.eprints.org/uk/> Website, 2016, accessed 5<sup>th</sup> May 2016.
14. SDS, <https://www.kent.ac.uk/hsugo/sds/index.html/> Website, 2016, accessed 5<sup>th</sup> May 2016.
15. pFact, <https://researchcoordinatorblog.wordpress.com/tag/full-economic-costing/> Website, 2016, accessed 5<sup>th</sup> May 2016.
16. Mintrom M. Managing the research function of the university: pressures and dilemmas, *Journal of Higher Education Policy and Management*, 2008, 30:3, 231-244, DOI: 10.1080/13600800802155028
17. Viney I. Collection and analysis of research outputs and impacts, 11th euroCRIS Strategic Seminar: Metadata in Research Information System, 2013, 9-10 Sept, Brussels. Available online at: [http://dspacecris.eurocris.org/bitstream/11366/270/1/Ian\\_Viney\\_Strategic\\_Seminar\\_2013.ppt](http://dspacecris.eurocris.org/bitstream/11366/270/1/Ian_Viney_Strategic_Seminar_2013.ppt) accessed 5th May 2016.
18. de Castro P, Warner S. ORCID Implementation in Open Access Repositories and Institutional Research Information Management Systems, OR13, 2013. Available online at: [http://or2013.net/sites/or2013.net/files/ORCID\\_OR13\\_proposal/index.pdf](http://or2013.net/sites/or2013.net/files/ORCID_OR13_proposal/index.pdf) accessed 5th May 2016.