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Engaging Industry in Empirical Research

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Abstract

***Background**: Companies can only capitalise on research that is relevant to their problems, usable in practice and brought to their attention. Such high value research almost always requires academic and industrial collaboration. **Problem:** Many academic information systems and software engineering researchers struggle to engage industry in their research. **Aim**: To investigate the gap between academic research and industry participation in information systems and software engineering. **Method:** An analysis of UK and Australian Research Council funded information systems-related projects in which companies and academics are currently collaborating. **Outcomes**: Only 20-30% of research council funded information systems-related projects have industry collaborators. Many collaborators in research projects are in the public sector and have been involved with research previously. **Impact**: Our results can contribute to increased industrial collaboration in research projects by helping researchers to identify projects most attractive to industrial collaborators and to target companies most likely to agree to participate in research projects.*

Keywords

Industrial Collaboration, Research

INTRODUCTION

Some of the most successful advances in information systems (IS) and software engineering (SE) are the result of academic and industrial partnerships. For example, NASA's long standing SE collaboration with academia has resulted in the implementation of highly effective new technologies (Basili *et al.* 2002), while Microsoft remains the only company to be ranked in the latest assessment of top SE institutions (Wong *et al.* (in press)). Such academic-industrial partnerships are increasingly being recognised by government agencies as an important mechanism for capitalising on research innovations. Government agencies are increasingly promoting technology transfer initiatives, for example the UK's Knowledge Transfer Partnership scheme supported 1048 academic-industrial partnerships in 2006/7 compared to 852 in 2003/4 (KTP 2008). Furthermore, research councils strongly encourage researchers to set out commercial exploitation plans in their applications for research funding.

Although industry-academic partnerships can successfully deliver IS innovations, many researchers continue to work in isolation from industry. This lack of collaboration is one reason that a great deal of academic research is unlikely to ever transfer into industrial practice. Much academic research will probably remain as academic 'shelfware' that fails to attract the attention of practitioners. There is consequently a massive undercapitalisation of research resources, where the real-world impact of a great deal of academic research effort in IS being lost.

However, individual researchers are usually very keen to get industry involved in their research. '*But how do we get industry to take notice of our research?*' is a recurrent discussion in most academic workshops and conferences, with many researchers struggling to get industry interested in their work. Many academic researchers want their research to be relevant and useful to industry, but simply do not know how to engage industry in their work.

We identify at least five reasons why industry does not engage with academic researchers:

- **Not relevant.** Most research that targets industrial adoption anticipates or assumes the problems companies face without actually finding out what the problems are. Consequently such research often misses the mark because it is based on misunderstood or wrong assumptions.
- **Not noticed.** Academic research that is relevant to industry is incredibly difficult to get noticed by the right people in industry. Even when it is noticed, persuading companies to participate in research projects can be difficult.
- **Not engaged.** Industry people struggle to get academic research support for the real world problems that they are facing.
- **Not timely.** The lead times for academic research deliverables are often too long for industry. In addition industry development cycles and technology adoption decisions sometimes move faster than academic constraints can easily cope with.
- **Not consistent.** There is often a conflict between academics needing to publish and industry wanting to protect their intellectual property.

The gap between researchers and practitioners may widen further as fewer industry practitioners seem to participate in many of the conferences attended by researchers. Instead practitioners seem to increasingly gravitate to industry–oriented conferences such as Software Practice Advancement (SPA) or Software Engineering Process Group (SEPG). This may result in even fewer opportunities for researchers and practitioners to meet, discuss and understand each other's worlds.

In this paper we analyse research projects in which industrial collaborators are currently involved. We analyse research projects funded by the UK and Australian Research Councils over the last 5 years. We focus on answering the following research questions:

RQ1: In which research projects does industry participate?

RQ2: Which companies participate in research projects?

The answers to these research questions uncover the features of research projects that have already successfully attracted industry collaborators. Our results also reveal the characteristics of companies that have previously agreed to participate in research projects. Our findings present academic researchers with historical information on which to more effectively approach potential industrial collaborators with a research project likely to appeal to them. Our results guide researchers to:

- Identify research that is relevant to companies
- Package their research to be most attractive to companies
- Approach companies most interested in research collaborations

In the following section we analyse background work from the literature. In Section 3 we describe our methodology. In Section 4 we present our results and in Section 5 we discuss the implications of our work and answer our research questions. We conclude and summarise in Section 6.

BACKGROUND

The lack of synergy between research and practice in IS and SE has long been reported. Potts (1993) discussed the failure of the sequential 'research-then-transfer' model prevalent in SE. He reported that this approach fails to address significant industry problems and that research outputs are haphazardly transferred into practice and undervalued by the research community. Instead he advocated an emphasis on what can actually be done in practice rather than what is possible in principle. He recommended more widespread use of the 'industry-as-laboratory' model (Potts 1993). This model has begun to successfully incubate SE innovations at NASA (Basili *et al.* 2002).

Glass (1994) has subsequently been a sustained advocate of intensified relationships between academia and industry. He advocated a powerful agenda for the future of SE based on closer alignment of research and practice. His 2020 vision for the future was based on achieving three things: practice and research working together; good research results making it into practice and bad research ideas quickly getting discarded (Glass 1994).

Moody (2000) discussed similar issues in relation to the relevance and impact of IS research. He described IS as an applied rather than pure discipline that needs a focus on both increased knowledge (theory) and improved practices (practical). This dual focus has already started to gain momentum in IS and SE with the recent focus

on theory development (Hall *et al.* 2008; Hannay *et al.* 2007; Jeffery and Scott 2002) in combination with the emergence of the Evidence Based Software Engineering paradigm (Kitchenham *et al*. 2004).

Moody emphasises the disconnection between IS research and practice, where practitioners and researchers have formed independent communities who seldom overlap in terms of ideas generation or knowledge transfer. He identifies three underlying reasons for this separation of IS research and practice (Moody 2000):

- Research is not driven by practical needs but the interests of researchers and demand from publication outlets.
- Practitioners tend not to read academic journals, so few ideas make it into the practical domain.
- Practitioners rarely refer to scientific research to solve problems or make important decisions. Instead they rely on their own experience, peers, or advice from vendors or consultants.

All these issues are also relevant to both IS and SE. Indeed we have previously reported that SE practitioners value experience from peer groups over research evidence in making technology adoption decisions (Rainer *et al.* 2005).

Despite the gap between research and practice in IS and SE being discussed for many years, there is limited evidence of progress towards reducing this gap. Jeffery and Scott (2002) and Zannier et al (2006) conducted surveys of SE research and report that only about half of empirical SE studies use industrial data. Whereas Segal *et al* report that only a third of the empirical software engineering studies they analysed focus on real-world systems (Segal *et al.* 2005). They also report that only 27% of papers published in the Empirical Software Engineering Journal between 1997 and 2003 include practitioner authors.

However it is not easy to track progress on academic-industry collaborations as few of the regular surveys characterising the nature of SE` research, for example, (Ramesh *et al.* 2004; Wong *et al.* (in press)) explicitly explore the relationship research has with industry.

METHODOLOGY

We determined that to answer the research questions, we should need to: (i) analyse research proposals at initiation (to determine what projects initially attract industry collaborators and what projects are viewed positively by research councils to the extent that they fund them); (ii) evaluate research projects as they progress to completion (to determine what actually interests industry collaborators); and (iii) analyse conference and journal publications by authors with both academic and industry affiliations (to determine what outcomes are important to industry collaborators). The first phase was to analyse data on research proposals, as such data is readily available and should inform the further exploration of what actually takes place (data which is less readily available). We had hoped for this initial analysis to reveal some 'universal truths' to guide the further exploration, but were dismayed to discover a number of differences between the UK and Australia in terms of the features of projects in which companies collaborate – this may be a result of the peculiarities of each country's grant schemes or it may be a reflection of the cultural and economic differences between the two countries. We have decided to publish these initial findings, even though we are aware that the results may not be generally valid and that evaluation of the differences between the proposed work and the actual work is necessary to answer the research questions fully.

This paper reports the analysis of two sets of data relating to the proposed intentions of research projects with industrial collaborators that have received funding from a research council to commence. The first data set quantifies research projects with a named company collaborator currently funded by the UK's Engineering and Physical Sciences Research Council (EPSRC). The second data set quantifies academic-industry research projects funded by the Australian Research Council (ARC). We will describe the basis of these data sets and their analysis in the rest of this section.

The Data Sets

Engineering and Physical Sciences Research Council

EPSRC provides funds for UK projects addressing a wide range of research topics including computing, IS and SE. Data on all projects funded by EPSRC is available on the web (http://gow.epsrc.ac.uk). We focused only on projects EPSRC funds under their ICT programme and extracted two data sets from this site during January 2008:

- *Collaborative Computing projects*. These projects have at least one investigator based in a computing or computing-related university department and include a named non-university collaborator.

- *Collaborative Software Engineering projects.* These projects include a named non-university collaborator but have also been identified by their investigators as addressing SE topics. These projects are a sub-set of the collaborative computing projects.

These data sets include all currently funded projects funded under all calls and schemes.

Australian Research Council

Research and development funding for Australian universities is managed through the Australian Research Council (ARC) that manages the National Competitive Grants Program (NCGP). The NCGP comprises a range of complementary schemes, including two main research project competitive grants schemes:

- *Discovery Projects* provide funding for research projects that can be undertaken by individual researchers or research teams, and whose broad aim is to support excellent fundamental research by individuals and teams ((ARC) 2008a).
- *Linkage Projects* support collaborative research and development projects between higher education organisations and collaborating organisations from outside the higher education sector (the collaborating partner must make a significant contribution, in cash and/or in kind, to the project). The broad aim of Linkage projects is to encourage and develop long-term strategic research alliances between higher education institutions and industry in order to apply advanced knowledge to problems, or to provide opportunities to obtain national economic or social benefits ((ARC) 2008b).

These funding schemes are organised into six disciplinary groupings, each with a separate panel to review project applications and proposals ((ARC) 2008c).

Linkage Projects provide details of Australian research projects with industry partners and are the basis of the analysis for the Australian input to this paper. The publicly available information on Linkage Project funding outcomes is provided by year of funding, in contrast to the UK EPSRC projects reported above which are listed for on-going or 'live' projects. Linkage Projects are typically three years in duration, so projects funded in 2006, 2007 and 2008 were considered to be reasonably equivalent to the European projects. Australian research proposals are classified by the Research Fields, Courses and Discipline (RFCD) codes. RFCD code 280000 is designated for 'Information, Computing and Communication Sciences'. The funded projects analysed for this paper were those proposals submitted with an RFCD code of 280000 (or one of the sub-category codes). Proposals submitted under the 280000 range of RFCD codes are considered by the Mathematics, Information and Communication Sciences (MICS) panel.

Analysing the Data

There are three elements to our analysis:

Project Demographics

We extracted from both the EPSRC and ARC websites quantitative data describing the demographics of all computing projects with industrial collaborators relating to 'Duration of project' and 'Funding awarded'.

Industrial Collaborators

We analysed the industrial collaborators for all computing, IS and SE projects in more detail. We used the collaborators' own websites to identify further demographical data about collaborator organisations. We analysed each software engineering and ARC industrial collaborator in terms of the following features:

- *Multinational.* Very large companies operating across the world.
- *Consultancy*. The company provides consultancy services.
- *Software House*. The company has the features of a software house.
- *Related to public sector*. The company grew out from a publicly-funded organisation or the company uniquely serves a publicly-funded organisation.
- *Academic roots*. The company either: grew out from a university; has close links with a university; publishes papers or contributes to conferences.
- *Stated research capability*. The company does research or has a R&D capability.

We used each collaborator's individual web site to characterise companies according to these features. These features emerged as we collected company collaborator details, these features are grounded in the web published information about these companies and characterise the common features of these companies.

Research Topics

We investigated the features of UK ICT projects and all Australian ICT projects in more detail. We read the title and abstracts of each project from the Research Councils' websites. We then used content analysis to identify the themes of the grants. We derived the following themes to describe the project focus:

- *Theoretical advance*. Underlying theoretical understanding of a problem or solution is the focus, but there is no useable solution. In particular there is no software output.
- *Improved IS or SE technique*. A new or improved technique is delivered that will help future developers of systems. In these projects new tools and techniques are delivered.
- *Developing a specific application*. A new software system is delivered for a specific user application.

In addition we also noted any stated relevance to a particular application area the project has.

Threats to Validity

Level of Collaboration

In this investigation we consider only formal partnerships for projects that have been funded by a Research Council. This is a relatively intensive form of collaboration. By only investigating such collaborations we do not account for the less intensive collaborations that are likely to be active (for example informal discussions with individual practitioners). However collaborations with lower intensity are usually necessary as building blocks to the intensive collaborations we report.

Bias Introduced by Special Calls

The UK grants we analysed include projects funded under any of the EPSRC schemes and special calls. This in itself is not necessarily a source of bias as all projects may have industrial collaborators. However during the timeframe we cover a special call for unusually large projects is included. This may artificially inflate the mean size of projects and so we have indicated where we have accounted for this in our analysis.

RESULTS

Overall Profile of Research Projects with Industrial Collaboration

Table 1 shows UK ICT projects funded by EPSRC. It shows that considerably more UK ICT projects are based in computing related departments than non-computing-related departments (506 compared to 316). Furthermore Table 1 also shows that 27% of computing-based projects include an industrial collaborator compared to 32% of non-computing-based projects. Overall Table 1 suggests that, at about 30%, there are a relatively low proportion of collaborative ICT projects.

Table 1. EPSRC Overall ICT Projects

	Non-computing based projects		Computing based projects	
	No industrial partner	Industrial partner	No industrial partner	Industrial partner
Number of projects	215	101	369	137
Percentage of projects	68	32	73	27

Table 2 shows some basic demographic details of the 112 funded UK EPSRC projects where the investigation team describe their topic of research as SE (they may have also selected other topic descriptors for their research). Of these 112 projects, 20% (23) listed industrial collaborator and, some of these listed several collaborator companies. This represents fewer projects with industrial collaborators than for computing projects generally, where closer to 30% of projects have industrial collaborators. Table 2 also shows that those SE projects with industrial partners received much higher funding than those without industrial partners.

We were unable to access comparable Australian data to that provided in Table 1. Instead we analysed 60 ARC Linkage grants as shown in Table 3. All of these include industrial collaboration as a condition of the grant. Table 4 provides details of ARC Discovery Grants that are projects without an obligatory industry partner.

Of the 111 proposals funded by the ARC MICS panel, 60 (54.1%) are in the 280000 range of RFCD codes. Tables 3 and 4 suggest that Linkage Grants receive far fewer grant proposals than Discovery Grants, but that they are more likely to be funded and at a similar funding level to Discovery Grants.

Table 2. EPSRC Projects

	No industrial partner	Industrial partner	Total
Number of projects	89	23	112
Overall funding	£35,652,407	£18,767814	£54,420,221
Mean funding per project	£400,588	£815,991[1]	£485,894

[1]Removing an outlying project that received £7M reduces this mean to £543,900

Table 3. ARC Linkage Grant Statistics

	2006	2007	2008
Proposals received	917	838	395
Proposals funded	363	392	192
Success rate	39.6%	46.8%	48.6%
Average 1st Year funding per project	AU$97,304	AU$99,551	AU$107,487
Average funding over project life	AU$300,965	AU$298,178	AU$318,706

Source: http://www.arc.gov.au/ncgp/lp/lp_outcomes.htm

Note that there are two rounds of funding for Linkage Projects and only one round has concluded for 2008.

Table 4. ARC Discovery Grant Statistics

	2006	2007	2008
Proposals received	3,766	4,074	4,121
Proposals funded	917	822	878
Success rate	24.5%	20.4%	21.4%
Average 1st Year funding per project	AU$103,786	AU$105,019	AU$106,469
Average funding over project life	AU$298,350	AU$334,267	AU$342,593

Source: http://www.arc.gov.au/ncgp/dp/DP08_SelRpt.htm

Themes Addressed in Projects with Industrial Collaboration

EPSRC Projects

In Table 5 we show the themes of the ESPRC projects with industrial collaborators classified according to the scheme we outlined above. It shows that the focus of these projects is spread between the three classification themes. There is a fairly even balance between theoretical and practical advances, complemented with a smaller number of new application developments.

Table 6 shows that many (40%) of ESPRC projects with industrial collaborators are not application area specific. However Table 6 also shows that those projects that are focused on an application area are overwhelmingly focused on security both in terms of public safety and system security.

Table 5. EPSRC Project Themes

Theme	Number of Projects	Percentage
Theoretical advance	9	45
Improved technique	7	35
Developing a specific application	4	20
Total	20	100

Note: Three of the ESPRC projects were excluded from this analysis as they were organising networking events rather than focused on delivering new findings.

Table 6. EPSRC Project Application Areas

Application	Number of Projects	Percentage
No specific application area	8	40
Public safety or security	5	25
System security	3	15
Health	2	10
Aerospace	1	5
Transport	1	5
Total	20	100

ARC Projects

Table 7 shows how the focus of ARC Linkage Projects is spread between the three themes. Table 7 shows a very different profile of project themes in the ARC projects to those of ESPRC projects (as shown in Table 5). A large proportion of the funded ARC projects focus on the development of an application or a piece of software (62%). The applications and software involved are generally reasonably specialised and presumably the proposals are justified on the basis of a research component in the application area. There may also be an unconscious or deliberate recognition of software development as a research activity in itself (Nunamaker and Chen 1990).

Table 8 shows the application areas addressed by the ARC projects. The profile of application areas is also very different from the UK's (as in Table 6), as the ARC grants focus mainly on Health related applications rather than Security, though also have a high proportion of non-specific application areas.

Table 7. ARC SE Project Themes

Theme	Number of Projects	Percentage
Developing a specific application	37	62
Theoretical advance	19	32
Improved technique	4	6
Total	60	100

Table 8. ARC Project Application Areas

Application	Number of Projects	Percentage
No specific application area	18	30
Health	14	24
Other[1]	14	24
Public safety or security	7	11
System security	4	6
Aerospace	2	3
Transport	1	2
Total	60	100

[1]The 'other' category includes manufacturing, ecological, play, water resource management systems etc.

Companies Participating in Research Projects

EPSRC Projects

Table 9 presents the self-selected sector descriptors for projects with industrial collaborators (note that projects may select more than one sector descriptor). 'Software' is the most quoted sector (this is generic and not particularly useful to our analysis).

Table 10 presents our own analysis of the company collaborators involved in the EPSRC projects (note that projects may have more than one industry collaborator). We derived these six features by examining the profiles of each company as publicised on their individual websites. Table 10 shows that the type of company collaborating is fairly varied, with a fairly even spread of consultancies, software houses and multinationals. However Table 10 also shows that a relatively high proportion of companies collaborating in research projects either have their roots in academia or have demonstrated a research capability. Similarly companies related to the public sector are also represented in the collaborative projects. In addition to the companies described in Table 10, another eleven non-commercial organisations also collaborated in the EPSRC projects. A high proportion of these non-commercial organisations are police and government agencies which may explain the emphasis on security noted above.

Table 9. ESPRC Project Sector Descriptors

Sector	Frequency	Percentage
Software	16	57
Communications	5	18
Transport	3	10
Aerospace and Defence	2	7
Healthcare	1	4
No relevance to underpinning sector	1	4
Total	28	100

Table 10. ESPRC Industry Collaborator Type

Type of Company	Frequency	Percentage
Consultancy	12	23
Software House	11	21
Demonstrated research capability	9	17
Multinational	8	15
Academic roots	7	13
Related to public sector	6	11
Total	53	100

ARC Projects

Industry collaborators in ARC projects are not required to self-select sector descriptors so no analysis equivalent to Table 9 is possible. Table 11 shows the profile of companies collaborating in the ARC projects (note that projects may have more than one industry collaborator). Table 11 shows that there are fewer consultancies represented in the ARC projects than in the EPSRC projects. Most ARC collaborating companies are either software houses or multinationals. This may indicate structural differences in the Australian commercial environment rather than in the nature of companies collaborating in research projects. Otherwise, Table 11 shows that the profile of ARC and ESPRC collaborators is fairly similar. Companies with their roots in academia and which demonstrate research capability feature strongly in this group of companies. In addition to the companies described in Table 11 another twenty-nine non-commercial organisations also collaborated in the ARC projects. Table 12 indicates the type of non-commercial organisations collaborating in projects. Table 12 shows that a high proportion of these organisations are government agencies (12 out of 29).

DISCUSSION

Overall our results suggest only between 20-30% of research council funded projects both in the UK and Australia have an industry collaborator. This is a lower than expected level of collaboration between industry and academia, which confirms that there is considerable opportunity for more engagement between industry and researchers.

Our results also indicate that a relatively high proportion of collaborators are either non-commercial organisations or related to public bodies. This suggests a bias in the type of collaborators getting involved in research projects. This may mean that large sectors of industry are not getting involved in research at all. It may also mean that whole parts of the discipline are evolving without real world input.

Table 11. ARC Industry Collaborator Type

Type of Company	Frequency	Percentage
Software House	21	30
Multinational	14	20
Academic roots	11	16
Demonstrated research capability	10	15
Related to public sector	6	9
Consultancy	6	9
Other	1	1
Total	69	100

Table 12. ARC Non-commercial Collaborator Type

Type of Company	Frequency	Percentage
'Not for profit' organisation	11	44
State government	6	24
Federal government	3	12
Local government	2	8
Hospital	2	8
International government	1	4
Total	25	100

In the rest of this section we address our original research questions in relation to current research projects with collaborators.

RQ1: In which Research Projects does Industry Participate?

Our results suggest that application area is not particularly important to collaborator companies. About 40% of UK collaborative ESPRC projects and 30% of Australian Linkage projects do not focus on a particular application area. Such projects tend to focus on developing and improving methods and techniques that have generic application, but which are particularly relevant to the collaborator company.

Where projects are focused on a particular application area our results suggest that popular application areas are those high on a country's current agenda. In the UK the high number of collaborative projects focused on security reflects the country's current preoccupation with security matters. Similarly, in Australia, heath is a highly represented application area in collaborative projects.

Projects which are focused on a particular application area include collaborator companies matched to those application areas. For example, the UK emphasis on security is matched by a high number of police and government agency collaborators.

In terms of the type of research that collaborators get involved with our results suggest that both theoretical and practical advances are almost equally attractive to collaborators. Our results also show that in Australia there is a lot more emphasis on developing specific applications than in the UK.

Funding for collaborative projects seems to be much higher in the UK. Our results suggest that in the UK collaborative projects can attract up to double the amount of funding. This is partially explained by the fact that collaborative projects also tend to be longer projects in the UK. However, this funding difference is not reflected in the ARC projects, where there is little difference in timescales or funding levels between the Discovery and Linkage grants.

Overall there are a number of differences between the UK and Australia in terms of the features of projects in which companies collaborate. This may be a result of the peculiarities of each country's grant schemes or it may be a reflection of the cultural and economic differences between the two countries.

RQ2: Which Companies Participate in Research Projects?

Our results suggest that no particular type or size of company is more or less likely to collaborate in research projects. However previous exposure to research, in terms of links to academia or having demonstrated an existing research capability seem more likely to pre-dispose companies to collaborate. Non-commercial organisations (for example health providers and charities) as well as public organisations such as police agencies also seem more likely to participate in research projects.

We can speculate on why such organisations seem more likely to collaborate in research projects; for example, they may value research more highly. Such organisations may have the resources or the culture to do research themselves or have derived benefit from research previously and therefore understand the value of research. Such organisations may have existing links with academics and have collaborated with researchers previously, indeed some of these organisations originated from academia. These organisations may be the easiest for researchers to penetrate, as their structures may be public and there may be a designated University liaison post.

CONCLUSIONS

Our findings confirm that there is a relatively low proportion of Research Council funded projects with industrial collaboration (only 20% of UK ESPRC projects having industrial collaborators). This may mean that some parts of the discipline may not have any input from the real world.

Our findings also suggest that some organisations dominate in research collaborations (for example public bodies and companies related to public bodies). This may also mean that some industry sectors are barely contributing to research.

This study starts to build a picture of the type of research most relevant to industrial collaborators and the types of companies most likely to agree to collaborate in research projects. Our results suggest that researchers should target companies which:

- have demonstrated previous research capability or have existing connections to academia;
- are public bodies or companies related to the public sector.

Our results also suggest that researchers approach companies with projects that:

- address current country-specific concerns;
- tackle existing generic technical problems.

FUTURE WORK

As well as extending this analysis to EU research projects, in the future we plan to develop this work in the following directions:

1. Survey researchers in collaborative projects to investigate how they identified suitable collaborators and how they persuaded collaborators to get involved in the project.
2. Understand the collaborations that lead up to the research projects analysed here. Such collaborations are likely to be the building blocks that support the development of, and culminate in, the intensive collaborations that we report in this paper.
3. Evaluate research projects as they progress to completion, including analysis of academic-industrial collaborations in terms of: industrial co-authorship of papers and empirical studies based on companies.

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