Developing new paradigms for cooperative research with the packaging industry—a theoretical framework.

Anthony Elliott*

** Faculty of Design, Swinburne University of Technology*
Melbourne, Australia. aelliott@swin.edu.au

Abstract: Collaborative research projects between industry and universities offer significant scope for the development of new ideas and practices. These collaborations benefit both industry and higher education. However, the range of cooperative opportunities is limited by current industry and academic practices. Packaging design requires efficient, accurate and complex design research. Industry research is undertaken more rapidly than is often practical for university study programs, which presents a significant problem for integrating collaborative projects. This paper provides a summary of academic insights into cooperative research practices.

It outlines the benefits and risks of collaborative projects and identifies how some of these problems have been addressed. It offers a foundation to inform further research into collaborative practices that will meet the specific demands of packaging design. Better collaborative models will increase opportunities to fund design research, offer cost effective research to industry and offer better graduate outcomes.

Key words: industry-education interface, industry collaboration, packaging design.

1. Introduction

Collaborative research projects between industry and universities offer significant scope for the development of new ideas and practices. These collaborations benefit both industry and higher education. However the range of cooperative opportunities is limited by current industry and academic practices. Packaging design requires efficient, accurate and complex design research. Industry research is undertaken more rapidly than is often practical for university study programs, which presents a significant problem for integrating collaborative projects. This paper provides a summary of academic insights into cooperative research practices. It outlines the benefits and risks of collaborative projects and identifies how some of these problems have been addressed. It offers a foundation to inform further research into collaborative practices that will meet the specific demands of packaging design. Better collaborative models will increase opportunities to fund design research, offer cost effective research to industry and offer better graduate outcomes.

2. Background

2.1 The problem

Industry, research and design projects are undertaken at a more intense pace and over time spans that do not align well with the structure or practices of university academic programs. It is therefore often impractical for university study programs to accommodate many otherwise valuable industry based research projects within an

academic calendar. This presents significant problems for interested parties to formulate or implement cooperative projects. However, there is a significant body of evidence illustrating and supporting university/industry collaboration. [2–3,10–11,14]. Both universities and industry have, and continue to evidence through continuing participation, a willingness to engage in cooperative projects, recognizing that there are significant benefits for each to be derived from collaboration. However industry collaboration interests do not always align with the interests of universities—and *visa versa*. In practice this may have no overall bearing on the outcome of the collaboration if the focus of interests do not impair each other. A project may exhibit individual, but dissimilar rewards for each party. This is evidenced by Lee [10] and reiterated by Hall [7].

Occasionally however, conflicts of interest can occur. Issues of intellectual property ownership and use of research or design material have been primary areas of concern [7]. This can present potential areas of conflict, and lead to a breakdown of a project, influence or eliminate the opportunity for future ventures.

Universities benefit from the integration of industry practices into curriculum content, offering students direct access to current industry practices to maximize graduate potential and to facilitate real world learning (see; Herrington & Oliver) [8]. Real world learning ensures that graduates moving into industry positions are better equipped with experience related their discipline. This improves their integration into industry roles.

Universities, through cooperative projects, can access new avenues of research and develop new research methods and knowledge outcomes. The outcomes of cooperative projects can improve or develop research methods that are based on industry experience (in addition to academic experience) and foster alternative funding or academic support to facilitate advanced education outcomes.

Packaging design outcomes are informed by—or derived from extensive research, in order to develop precise design outcomes. These design outcomes include the mundane but immensely profitable fast moving consumer goods (FMCG) for global markets. FMCG outcomes require extensive research input to address user centered design, consumer behavior, strategic marketing, ethnographic, linguistic and visual communication issues.

In contrast to FMCG, packaging designer also deals with the development of solutions for sensitive sustainability issues that address the containment and protection of socially or environmentally significant products. This includes the development of goods for humanitarian aid, medical or emergency equipment. These demand significant research and interrogation into culture, user context, visual language and communication strategies.

2.2 The Gap

Little if any academic work has been published on the topic of collaborative projects specifically for post graduate or undergraduate courses in packaging design. This poses several questions. Is it because little or no collaboration has existed between universities and industry in the field of packaging design, and if so, then why? Is industry and academic research and design collaboration incompatible? Has no one yet recognized the opportunity—or are universities not making industry aware of the potential to engage with cooperative project ventures in this sector of design practice?

What does support collaboration is the body of evidence indicating the willingness of universities—including design faculties—to undertake collaborative projects and research.

In 1996, Lee [10] published an examination of the emerging ‘technology transfer’ role that US academics were expected to play in (US) economic development. The paper examined what roles academics believed they could

play in industrial innovations and how they would collaborate with private industry. This work offers some insights into industry/university relationships.

3. Discussion

3.1 Why do academics need university-industry collaboration?

A paper by Blumenthal, *et al,* [2] established that 'researchers with industrial support publish at higher rates, patent more frequently, participate in more administrative and professional activities.' While this is important for universities and research academics, little was noted on the effect of these alliances on education.

Specifically addressing collaborative projects for design, deVere [14] states, 'industry partners are critical to the relevance and success of (our) course…projects permit student access to critical 'in-house' industry experience and provide critical analysis and feedback from a commercial, (and an) educational, perspective. Working closely with industry partners develops real world methods and provides a validity and relevance to student outcomes.' These offer universities improved avenues for research and research outcomes, integrate valuable industry practices into university programs and curricula, facilitate real world experiential learning within university education and maximize the integration of graduates into advanced industry roles.

3.2 Do universities and industry want collaborative projects?

Arbor [1], reported that 'the research policy community has produced a significant body of empirical research on (the) benefits of cooperative research between industry and university.' Publications from the US, notably by Blumenthal [2–3], Arbor [1] and Lee [10–11] spanning a 15 year period, broadly concur on both the benefits and general goodwill by academics toward cooperative alliances.

Reviewing a ten-year study of university-industry research collaboration, Blumenthal *et al* [3], found that 'the characteristics of (industry-university cooperative) relationships (had) remained remarkably stable' reporting that 'after more than a decade of sustained interaction, universities and industries seem to have formed durable partnerships'. Lee [10] also found that 'academics believed they were more favorably disposed…toward closer university/industry collaboration.' The majority of the respondents of Lee's survey supported the idea that universities 'should participate actively in local and regional economic development, facilitate commercialization of academic research and encourage faculty consulting for private firms.' A later study by Lee [11], reported that an overwhelming majority of participants representing both universities and industry said that in the future they would expand or sustain their present level of collaboration. Lee concludes that 'the concept of university-industry collaboration is an important social experiment in the nation's innovation system' [11].

3.3 The advantages of collaboration for industry and universities.

Research by Lee [11] records that all participants in research collaboration appear to realize significant benefits' and that for universities the most significant benefits for faculty members were 'complementing their own academic research by securing funds for graduate students, and by seeking insights into their own research.' Lee found that 'the most significant benefit realized by (industry was) an increased access to new university research and discoveries'[11]. A paper by deVere [14] on managing cooperative design projects for product design, evidences the success of his undergraduate cooperative industry projects. Citing, in 2007, that 'of the projects conducted by his final year students, over 40% had industry partners keen to continue (project) development into

production.' This offers students learning experiences that extend into real world outcomes and provides tangible evidence of their capacity to undertake and realize industry standard projects.

While declaring that there was significant evidence to support university/industry collaboration Arbor *et al*, [1] observed however, that the research policy community has 'all but ignored empirical study on the costs or unintended consequences of these activities' (eg: erosion of academic freedom).

3.4 Potential problems with Industry/Academic partnering

Research by Blumenthal, *et al* [2] raised questions concerning the effects, both positive and negative, on universities. These earlier findings strongly suggested that university/industry research relationships have both benefits and risks for academic institutions. They found that university faculties with industry funding were much more likely to report that 'their research has resulted in trade secrets' and that commercial considerations 'had influenced their choice of research projects'. Those findings are supported by research conducted a decade later by Webster [15]. Webster found that 'growing commercialization of university (collaboration)…often led to claims that research (was) being distorted by corporate influence'. Webster concludes that 'the challenge for universities is to find ways to manage these relationships that will preserve the benefits while minimizing the risks.' Blumenthal, *et al* [3] indicated that 'despite growing acceptance of relationships between academia and industry (that) systematic, up-to-date information about their extent and the consequences for the parties involved remains scarce.' They warn that industry relationships 'may pose greater threats to openness (in their example study of scientific communication) than universities generally acknowledge.' Similarly, one factor that stood out in Lee's study [10] as central to the debate on university technology transfer was that the 'impact of close university-industry cooperation (was) likely to interfere with academic freedom.' Arbor *et al* [1], attempted to inform this topic about benefits vs. costs of cooperative research. This study involved the development and evaluation of a measure of "climate for academic freedom". Their results concluded that sponsorship by industry did not negatively affect student experiences or outcomes.

3.5 Priorities and conflicts of interest

While industry and universities may find considerable ground for collaboration, this does not mean that they have mutual interests. Lee's [10] survey of university and industry participants ranked in order, that *industry participants* placed a high priority on access to new research, development of new products, maintaining a relationship (with universities), obtaining new patents and solving technical problems—and a low priority on improving products and recruiting students. While in contrast *academic participants* placed a high priority on obtaining funds for research assistance with their own research agenda and obtaining insights into their own research by being able to field-test theory and empirical research. Academics placed a low priority on, acquiring practical knowledge useful for teaching, student internships and job placement, obtaining patentable inventions and fostering business opportunities [10].

This survey highlighted differences in motivations and interests in collaborative projects. Whether this would infer conflicts or merely special interests is moot. It would however be necessary to assess the issue of priorities and interests when developing outcomes of this study.

3.6 Intellectual property rights

A survey by Hall [7] citing attitudes to collaboration, reported that 31% of the industry participants identified that intellectual property (IP) issues, were an insurmountable barrier to partnering. Participants commented that they believed that industry owned the IP developed under sponsored research, and that a significant problem was that many universities wanted to publish results prior to IP protection—and sometimes would not grant exclusivity.

Within the context of general design practice, IP is commonly the property of the design studio until or unless transacted by the client. Introducing third parties (the university, and then the individual students engaged in the project) poses further problems of ownership of IP—and the rights to use this IP for academic or individual student promotion. Students for example may want to include details of cooperative research projects or outcomes as evidence of academic undertakings. deVere [14] offers insights that address the issues of intellectual property rights for design education interests by embedding into cooperative design projects, a university policy that allows students full ownership of their design outcomes derived from their cooperative projects. This policy permits students to negotiate with cooperative industry partners to realize the product commercially. In the case of these projects, (the university) is 'often required to sign non-disclosure agreements with emerging technology partners, and specific details of a student's design are often precluded from display at the graduate exhibition(s) because of the sensitive nature of either technology or application.' This example appears to offer a satisfactory agreement in deVere's case, for both academic and industry interests in relation to collaborative design outcomes.

While agreements such as this can exist to address this issue, this problem is not resolved unless industry is content recognize the designers ownership to the design IP from the outset, and are content to renegotiate that IP for their commercial use. If not, then such agreements may pose an impediment to cooperative project opportunities. It is equally plausible that industry could view the education partner, particularly a student, as an employee (paid in kind) and claim the IP as their own. Blumenthal *et al* [3] records that industry relationships with universities 'often included agreements to keep the results of research secret beyond the time needed (for example) to file a patent'—presumably to deny the university partner access to use or exploit IP derived from the project. In addition to disputes over IP, industry may view universities as inadequately secure and fear breach of confidentiality. The security of IP can concern both studios and the commercial clients involved with cooperative projects. Clear agreements with industry are of significant importance to the success of these projects. deVere [14] states that 'well-articulated agreements can lead to successful outcomes for the student, including employment post-project and future royalties.'

3.7 Education issues

In a design education context, deVere [14] notes that 'issues arise when student objectives and educational requirements conflict with the commercial constraints of the industry partner.' Adding that student learning experiences and creativity 'may be restrained by economic or manufacturing restrictions imposed by their project partner'. Additionally, projects can be delayed or postponed by industry for periods of time, for commercial, legal, manufacturing or marketing reasons. This presents a significant problem for industry to retain continuity, economy and reliability of research outcomes—and for universities to offer reliable education outcomes. deVere also cites a difficulty with ongoing student engagement with projects beyond their own

academic interests stating that 'students are often reluctant to engage any further in the development process (with a project, once having completed) the academic requirements of the project. Students, he observes, will 'utilize their project research and design documentation to prove their credentials for employment, and after course completion, see the project as having achieved its purpose' [14]. Student commitment to a project beyond their immediate interests then, is another factor for consideration. This can pose a problem for industry partners whose investment in the development of a design outcome may extend further than the window afforded by a conventional academic timetable. Industry projects that run for a year or more, for any reason, may, for example, need to accept a second generation of collaborative students to complete the project. This may present difficulties with quality and consistency and further complicate IP issues.

4. Government support and funding for industry-university research collaboration in Australia

Government engagement with complex long-term collaborative research projects has met with significant success. In the context of collaborative research in Australia, the Department of Innovation, Industry, Science and Research (DIISR) has an established record of facilitating collaborative innovation.

Specifically, the DIISR [6] cite that 'the education system plays an integral role in fostering innovation, leadership and entrepreneurial culture as well as having a pivotal role in supporting (research and development) and commercial outcomes from research. This requires greater emphasis on innovation and innovative thinkers in all tiers of the education system'. They note particularly an emphasis on 'more effective and greater engagement between students, teachers and the curriculum across education sectors, with industry and research institutions'. The DIISR is also responsible for the Australia's Cooperative Research Centre (CRC) initiatives. They support Australian research through CRCs by providing critical research infrastructure, equipment and facilities. This scheme fosters development through collaboration by funding collaborative arrangements between higher education, industry, and other organizations. Cooperative projects with via CRCs and industry partners offers universities alternative funding pathways to research output and offers potential for wider research opportunities.

In 1991, DIISR established Cooperative Research Centre (CRC) projects. The objective of the program is;

> *(To provide) 'funding to build critical mass in research ventures between end-users and researchers which tackle clearly-articulated, major challenges for the end-users.*
>
> *CRCs pursue solutions to these challenges that are innovative, of high impact and capable of being effectively deployed by the end-users* (and) *deliver significant economic, environmental and social benefits to Australia by supporting end-user driven research partnerships between publicly funded researchers and end-users to address clearly articulated, major challenges that require medium to long term collaborative efforts'. The CRC Program links researchers with industry to focus R&D efforts on progress towards utilization and commercialization. The close interaction between researchers and the users of research is a key feature of the Program* [6].

What is significant also for universities is the 'industry contribution to CRC education programs to produce industry-ready graduates.' There are currently about 50 CRC projects across Australia of a total of 168 CRC programs since 1991. To date $12.3 billion (cash and in-kind), has been allocated to CRC programs [4].

While the range of CRC research areas is diverse, only one design faculty in Australia, Swinburne University, Faculty of Design has to date, been granted CRC project funding.

In Australia, while the importance of industry-university cooperative projects is recognized and underscored by government support, large scale funding for design research is not well represented in comparison to other academic disciplines in Australia. What does exist reflects a growing recognition of design research.

However, in spite of the blanket reference by the DIISR to funding collaborative arrangements between higher education and industry—at present this funding has only supported postgraduate collaborative research. There is no evidence of CRC initiatives for undergraduate research.

5. Problems with industry funding support

Blumenthal *et al* [3] observed that financial support from industry for university research 'is much smaller in amount than (government) support' and Lee [10] cautions on the potential risk of over reliance, or dependence on private industry to support research. As a measure of this, in Australia, industry has contributed only around 20% of the total funding to (CRC) programs, universities have contributed 25%, and the remaining 55% of funding has come from government sources, either directly, or indirectly through Commonwealth research bodies. Additionally, industry support for collaborative projects is influenced significantly by prevailing economic conditions, adding the potential for funds and/or project opportunities to diminish in times of economic volatility.

6. Monitoring and managing collaboration

'Blumenthal, *et al* [2] says, 'the challenge for universities is to find ways to manage (industry/university) relationships that will preserve the benefits while minimizing the risks.' Collaborative projects must satisfy the expectations and aims of both education and industry. While as noted earlier, interests may differ for each party, [7][10] they must not conflict with each other. Mapping transparent agreements in which reasonable expectations can be assured and measuring whether those are being achieved, is paramount to the success of cooperative work. deVere [14] states that 'the project intent must be carefully aligned with the expectations of all involved parties, especially the technical partners who provide expertise and resources with the expectation of free research and development'.

7. The relevance to packaging design

How does this relate to packaging design? The evidence in this paper is taken almost exclusively from industry collaboration with the sciences or engineering. These are established areas for collaboration. The outcomes from these joint arrangements are manifold. They offer potential patenting rights and royalties, attract financial and material rewards and offer significant prestige for both industry and universities. They offer significant academic benefits in the form of more relevant learning experiences and outcomes to students. These successes in turn help to generate academic interest and improved opportunities for research.

A significant amount has been published about successes and shortcomings of these collaborations but little has been written on cooperative projects for design disciplines, and to date nothing related to packaging design.

Yet packaging design, like all other design disciplines (or even more so) requires research skills to formulate and focus design outcomes. This is evidenced in industry practice.

8. Design and research

Heller [9] states that 'the most recent discourse to hit (design) academia centers around 'quantifiable research', or rationalizing through data, why particular designs are produced (and) for what purpose…training students to produce effective research is a positive addition to their skill set.' Design deals with communication, identification, and function. With—what or how—we interact with design outcomes. While design is seen to some extent as intuitive, it relies on research to properly inform ideas that solve problems. Heller [9] notes that establishing 'how students are taught to research—so it enhances their physical output as it expands their creative freedom—is the next big academic challenge.' Like all fields of design, there is a need to apply research methods for packaging design. However there are few documented examples of cooperative research projects between universities and the packaging design industry. While cooperative work may, and probably has occurred, little has yet been reported by design academics.

9. What is packaging design?

Disappointingly the Compact Oxford English Dictionary [12] defines packaging as; *'materials used to wrap or protect goods'*. This economically prosaic description would no doubt disappoint any whose careers are built on this complex topic. The Merriam-Webster Dictionary [13] is more expansive.

Packaging *1. to make into a package ; especially : to produce as an entertainment package b: to present (as a product) in such a way as to heighten its appeal to the public; 2: to enclose in a package or covering*.

One factor effecting the perception of packaging design is that it does not always appear to deal with matters of great material or social importance. Thus here, *'to present (as a product) in such a way as to heighten its appeal…'* is most commonly, how packaging design is perceived. The reality of packaging design is more complex and sophisticated. Packaging engages with complex research and user testing to develop and resolve design problems. Packaging designers must have a sound knowledge of communication and corporate identity design, consumer psychology, issues of language and culture, design for the ability impaired, a working knowledge of product design, advanced print technologies, materials science and environmental sustainability.

The packaging industry engages in and requires ongoing research to interrogate complex marketing and promotional interests, position identity and content in commercial and public contexts, solve important needs for containment and the protection of goods, develop and implement environmentally sustainable designs and innovate, or identify and apply, new materials that solve packaging problems.

Packaging design embraces areas of social need as well a commercial interests. Medical, pharmaceutical and humanitarian aid design problems are resolved through innovative packaging design thinking. Environmental impact is a fundamental aspect of every design for packaging.

10. The role of Industry in design education

Design education has an established and tested association with industry, both as reference point for advisory groups in curriculum development and as mentors and sponsors of design education. Industry groups advise on the relevance of curriculum content to future design practice. They identify and qualify key emerging issues and technologies and professional trends, that guide and inform design education. With the development of specific design disciplines over recent decades, design practice has moved from a relatively homogenous profession into areas of significant specialization. It is now common for university design faculties to offer a variety of

specialized and separate design disciplines. This refinement and focus of discipline areas is expected to continue into the future. What is emerging now from industry/academic dialogue is that packaging design is evolving as one of these new areas of industry specialization. With this specialization, comes specific professional knowledge and professional skills. What is evident from this research and from professional discourse are the benefits of industry/academic cooperation to successful outcomes.

While industry has played an important part in sponsoring and informing design education, better models for advanced learning are needed in order to address the problems of the past, and to speak to the future.

11. Further research

Several methods are required to interrogate this topic. This research would be undertaken principally within Australia in order to reflect Australian academic and industry practice, but insights would be sought from key international sources, in order to more broadly inform the topic.

These methods would include a comprehensive survey of current industry/university *collaborative practices*, a survey of industry/university collaborative practices *for design*, current research practices by industry for design and research practices by industry *specifically for packaging design*. A qualitative analysis of these findings will establish a set of strategies and the instigation of a trial program would test these strategies against current cooperative programs.

12. Conclusion

Universities and industry have, and continue to evidence, a willingness to engage in cooperative projects. Universities benefit from cooperative projects by having the opportunity to stimulate new research and research funding, develop new research methods, knowledge outcomes, and to access current and emerging industry trends and practices for integration into curricula. Cooperative projects offer students authentic learning and the opportunity to contribute to industry knowledge before they the reach industry as graduates, maximizing their graduate potential. Industry has an established association with design education as sponsors and mentors, as cooperative partners and as advisors on curriculum development and professional trends. Industry has identified that packaging design is an emerging key area of design specialization, however cooperative research projects between education and the packaging design industry are poorly evidenced.

This paper offers a background of the relationships between university and industry collaborations. It builds a key understanding of the topic in order to inform further research and establishes the first step into investigating the demands and interests of industry in their relationship with education.

This paper identifies shortcomings with existing collaborative practices and proposes that guidelines for improved practices to facilitate advanced learning will stimulate cooperative projects with the packaging industry. These guidelines will help to formulate new paradigms for collaboration with the packaging industry that will meet both industry and academic criteria. This would include agreements with industry partners that address intellectual property and confidentiality issues that ensures academic freedom and accommodates the differing time and research practices of both industry and academia. This will build better models for advanced learning and in turn invite more opportunities for cooperative projects.

13. References

[1] Arbor, A., Behrens, T. R. and O Gray, D. (1999) Problems with collaborative research projects—Unintended consequences of cooperative research: impact of industry sponsorship on climate for academic freedom and other graduate student outcomes.

[2] Blumenthal, D., Gluck, M., Louis, K. S., Stoto, M. A. and Wise, D. (1986) University-industry research relationships in biotechnology: implications for the university science, Vol 232, Issue 4756, 1361-1366, American Association for the Advancement of Science.

[3] Blumenthal, D., Causino, N., Campbell, E., and Louis, K. S. (1996) Relationships between Academic Institutions and Industry in the Life Sciences — An Industry Survey, New England Journal of Medicine, No. 6,Vol. 334:368-374.

[4] CRC, Cooperative Research Centres, (2009) Australian Government, Department of Innovation, Industry, Science and Research, (DIISR) Available at < https://www.crc.gov.au/Information/default.aspx> [Accessed 1 May 2009]

[5] DEST, Department of Education, Science and Training (2004) National survey of research commercialization: years 2001 and 2002: Selected measures of commercialization activity in universities and publicly funded research agencies, Report, published: October, 2004.

[6] DIISR, (2008) Department of Innovation, Industry, Science and Research, $31M FOR HANDS-ON RESEARCH GRANTS, Linkage Infrastructure, Equipment and Facilities (LIEF) Projects scheme. Available at <http://www.arc,gov.au/madia/releases/media_18Nov08.htm> [Accessed 1 May 2009]

[7] Hall, B.H. (2001) University-Industry Research Partnerships and Intellectual Property, NSF-CISTP Workshop –October 2001, p2–3.

[8] Herrington, J. and Oliver, R. (2000) An instructional design framework for authentic learning environments. Educational Technology Research and Development, 48(3), 23–49.

[9] Heller, S., Bennett, A. (Ed). (2006) Design Studies: Theory and Research in Graphic Design. New York: Princeton Architectural Press. Forward by: Steven Heller, *Better skills through better research,* p12–13

[10] Lee, Y. (1996) 'Technology transfer' and the research university: a search for the boundaries of university-industry collaboration. Department of Political Science, Iowa State University, USA.

[11] Lee, Y. (2000) The Sustainability of University-Industry Research Collaboration: An Empirical Assessment, The Journal of Technology Transfer, Volume 25, Number 2.

[12] 'packaging' (2009) The Compact Oxford English Dictionary Online, viewed 6 May 2009.

[13] 'packaging' (2009) The Merriam-Webster Dictionary Online, viewed 6 May 2009.

[14] deVere, I. (2008) 'Managing Industry Collaboration: Providing an educational model in a client-led project', International Conference on Engineering and Product Design Education, September 2008, Universitat Politecnica de Catalunya, Barcelona, Spain

[15] Webster, A. (1994) University-Corporate Ties and the Construction of Research Agendas, Sociology, Vol. 28, No. 1, 123-142