Asking the Industry Partners: Reflecting on the Value of Internships for Circular Design

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Abstract: As part of Circular Design: Learning for Innovative Design for Sustainability (L4IDS) Erasmus+ Knowledge Alliance project, a series of internships were conducted in collaboration with local industry partners and interns from four different European countries. The aim of these internships is to develop an adaptable training programme focusing on design for sustainability and circular economy with standardised educational tools and techniques, which can be replicated by other European HEIs. The internship projects were focused on local industry partners’ real-life challenges at the time, and industry partners, interns and researcher/educators facilitating the collaboration throughout the programme. While the immediate feedback upon the completion of the internships was generally positive, as authors we were interested in long-term effects of this experience on industry partners’ professional practices. This paper introduces the internship programme and industry partners’ involvement throughout it and presents the results of interviews with key contacts from each industry partner conducted a year after the internship ended to uncover what/if any changes occurred in practice. The paper presents some considerations on developing the structure of an internship programme on sustainability, ways of collaboration among industry partners, novice designers and universities, observed and potential effects on business practices, and limitations in implementation.

Keywords: design education; industry collaboration; knowledge exchange; design for sustainability; capacity building

1 Introduction
In the final report of the United Nations Decade of Education for Sustainable Development (2014), the role of higher education institutions was discussed widely through capacity building for staff (O’Rafferty, Curtis & O’Connor, 2014; Lozano, 2006), changes in learning outcomes (Shephard, 2008) and facilitating change in future practices (Zilahy & Huisingh, 2009). The report also highlights the rising demand from students for sustainability issues to be integrated into curricula (UN, 2014). For design education and research in higher education institutions, there are different levels at which universities can build the relationship between design practice and sustainability, including but not limited to:
• mainstreaming sustainability inherently throughout the design education (O’Rafferty et al., 2014; de Eyto et al., 2008),
• introducing modules focused on sustainability incorporating design practice (Boks & Diehl, 2006),
• intersecting design research activities on sustainability with undergraduate education (Doğan, Turhan & Bakırlioğlu, 2016),
• acting as intermediaries in industry through utilising the expertise of academics on design for sustainability (Küçüksayraç, Wever & Brezet, 2017).

In order to facilitate the deep learning of sustainability principles and its design-related competencies, a more holistic approach integrating these principles and competencies throughout the curriculum over an extended period of time can be adopted. This integration requires the development and adoption of a more hybrid approach, one that weaves sustainability concerns throughout the design education. This ensures that the concerns are addressed effectively in future design practices and not regarded as an additional design consideration (O’Rafferty et al., 2014; Boks & Diehl, 2006). Collaboration and knowledge exchange among different institutions to build educational capacity (O’Rafferty et al, 2014; McMahon et al., 2012) and between universities and industry to transform business practices (Küçüksayraç et al., 2017) are crucial for continued adoption of such a hybrid approach. There are many barriers that can be grouped under overcrowded curricula and limited expertise or awareness of staff (Sterling & Witham, 2008; Boks & Diehl, 2006; de Eyto, 2010) against such a shift in education. Fortunately, the UN Decade of Education for Sustainable Development (2014) presents promising outcomes of collaborative efforts among higher education institutions and stakeholders.

Following this line of thought, this paper introduces an internship programme that builds such collaboration among institutions and businesses, thus enabling novice designers to experience this complex relationship first-hand in the development of sustainable design solutions that can transform business practices.

Circular Design (Li4IDS) Erasmus+ Knowledge Alliance comprises four European institutions with design departments (University of Limerick (UL) in Ireland, Universitat Politècnica de Catalunya (UPC) in Spain, NHL Stenden University (NHL) in the Netherlands, Linköping University (LiU) in Sweden) along with four design-led SMEs (Small to Medium Enterprises) and four National Design Agencies. The project aim is to develop a training and exchange programme for Circular Design with an adaptable schedule conforming to the structures of the HEIs. This internship programme promotes a culturally-diverse, interdisciplinary working environment for students from varying backgrounds (i.e. Product Design, Business and Materials Science). There are three main goals for this internship:

1. to develop an adaptable training programme with standardised educational tools and techniques, which can be integrated into many existing design departments around Europe. This, in turn, can build interdisciplinary capacity within those departments to train future designers with a comprehensive understanding of sustainability, as well as ways of undertaking innovative design practice to tackle its issues.
2. to create training opportunities for novice designers and other disciplinary students on working in multicultural training environments and tackling the issues of different local contexts and local industry, through setting up student exchange programmes and bringing industrial partners into the training programme.
3. to facilitate knowledge exchange among industry partners and higher education institutions about Circular Economy, and to explore its practical implications for participating partners. Through becoming partners in the internship programme, industry partners can explore sustainable alternatives to their existing business models and ways to achieve such transition.

On September 1st, 2017 the first Circular Design internship started in UL with the attendance of 10 interns (i.e. three interns from UL, three from NHL, two from UPC and two from LiU). With this internship, a long-term collaborative action research process also started to further develop and optimise this internship programme that can be adopted by other European HEI Design Schools. This paper briefly introduces this long-term collaborative action research process and the internship structure. However, it focuses on the third goal of the internships and presents the industry partners’ reflection on the experience a year after the internship ended, to explore its effects on their businesses and consequent attitudes towards sustainable practice.

2 Developing a Circular Design Internship Programme

Action research is a commonly used methodology in educational contexts for the continuous development of curricula and educational content, as the distinction between them (i.e. development and education) is removed, and they are brought together as research (Mckernan, 2008). The educators’ role changes significantly as well; they become researchers that perform continuous self-evaluation and work on the problems they identified (Mckernan, 2008). The
development and the goals of this internship programme are beyond the capabilities of a single researcher. The attempt to create a programme repeatable within different curricula and content, no less an exchange programme to bring together interns of different understandings on issues of sustainability and the development of the programme requires a collaborative framework.

This internship programme is being developed by four HEIs in four different EU countries, who share similarities on their approach to design education (i.e. practice-based learning in a studio environment) and present differences in the structuring of curriculum and content (e.g. duration of bachelor education, courses, training, access to workshops, etc.). This complicates the development of a standardised internship programme with respect to the students’ differing backgrounds and the inclusion of the programme in existing curricula. On the other hand, the focus of the internship (i.e. sustainability and circular design) clarifies the common educational goals that help structure the internship programme. Hence, four higher education institutions agreed upon adopting an AR methodology through iterating the internship programme by reflecting on and building upon the previous implementation of it and providing reflections and guidance for the subsequent internships (Figure 1).

The first internship programme ran from September 1st to November 30th, 2017. Upon its completion, the researchers reflected on the internship and its outcomes, and this reflection along with all the internship material developed was sent to the next institution (i.e. UPC in Spain). The educators/researchers in the second institution reviewed the materials, reflected on the first internship and further developed the internship structure and content. At the time of writing this manuscript, the third internship in NHL, the Netherlands is being finalised, and the final internship will start in LiU, Sweden. The purpose of the iterative 4-phase process is to develop a comprehensive internship programme to train the next generation of designers for a sustainable future, which can be conducted in different design schools all around Europe and in collaboration with local industry partners.

For this framework, the knowledge transfer among lecturers/researchers needed to be well-structured to ensure the continuation of the action research thus reaching meaningful outcomes. The internship programme was developed according to key learning outcomes that were devised at the beginning of the first internship:

- Creating an environment for interns to self-learn and experience the necessary tools and techniques for Circular Design.
- Facilitating learning for innovative, sustainable design for both the interns and the industry partners throughout the design process.
- Present the potential of innovative design tools and techniques for sustainability and the circular economy as applied to real-life innovation processes.

While the project focuses on the development of the internship programme through its iterations in four European countries, this paper focuses on the industry partners’ reflections on the experience after a duration when any possible, long-term change is observable (i.e. around a year). As shown in Figure 1, nearly a year has passed since the completion of the first Circular Design internship in Ireland and the authors wanted to shed light on the possible long-term effects of the internship on the industry partner’s practices. Has the internship program affected the industry partners’ practices in delivering products and services, or were the outcomes of the internship put aside? Was such collaboration between university and industry partners beneficial to initiate professional development, or even transition toward alternative businesses? If they were to participate in such a programme again, what would they do differently, and why? Similarly, were they satisfied with the content, structure and implementation of the internship
programme, or would they seek improvements? Such feedback from the industry partners of the first internship can be reflected on the final Circular Design internship in Sweden and help improve it.

2.1 Industry Partners of the First Internship in Ireland

In the scope of the first internship in Ireland, researchers decided to find three industry partners with diverse needs, who are capable of realising projects of different scales. This diversified the type of projects undertaken, to observe the outcomes for these projects of different scales and to understand the potential of the internship to train individuals for diversely-scaled design projects. As a result, a craft-producer company (Mamukko), a furniture design consultancy (One Off) and a regional government institution (Southern Region Waste Management Office) agreed to become industry partners for the internship programme, and three different design briefs were developed, which are summarised as follows:

- **Material Explorations** with *Mamukko, Kinsale*: Exploring the potential of a reclaimed material – used fishing nets – and developing innovative solutions on reusing it along with leathercraft. The team consisted of four interns from UL, UPC, NHL and LiU.
- **Retrofitting** with *One Off, Dublin*: Designing bespoke, high-end office furniture with a take-back system and reusable products/parts/materials. The team consisted of three interns from UL, UPC and NHL.
- **Preventing Food Waste** with *Southern Region Waste Management Office (SRWMO), Limerick*: Reimagining the food waste management in/around Limerick and developing solutions for prevention and reuse of food waste. The team consisted of three interns from UL, NHL and LiU.

These projects present three distinctly different scales in terms of circular design. The **material explorations** project focuses on the reuse/recycling of a problematic material that is discarded in oceans, contaminating the sea and endangering marine life. The purpose of the project was to explore ways of introducing this material into SME production processes thus giving it a second life. The **retrofitting** project focuses on the problem of underused, high-end furniture with valuable materials being discarded before their potential lifespan ends and aims to explore ways of reusing the furniture or the materials used in the furniture with the limited organizational capabilities of a design consultancy. The **preventing food waste** project identifies the issue of excessive amounts of food waste produced by citizens and the cultural implications of this issue. The project aims to intervene in existing models of discarding food waste and its waste stream to explore ways of preventing food waste in the first place. Detailed information about the project briefs and scheduling can be found in Bakirlioglu et al. (2018).

Although the challenges of each project were quite diverse, they were regarded in the scope of the Circular Economy. These projects were well-positioned to observe the implications of Circular Design at different scales and how this internship programme can train the next generation of designers to respond to the diverse challenges imposed by a Circular Economy approach. It should also be noted that the industry partners for these projects were aware of the global and local issues related to sustainability, however, they needed assistance to respond to these challenges in the context of their businesses. The outcomes of this internship did not have to be applicable right away, rather these industry partners were interested in the Circular Design process and the opportunities it presented for their businesses. The enthusiasm of the industry partners was important to support the design process, and concurrently, the interns.

2.2 Internship Schedule and the Involvement of Industry Partners

To enable clarity for the interns and industry partners, and to let the interns experience an innovative design process from the beginning until the end, the internship programme was structured in four phases (i.e. Research, Ideation, Detailing and Prototyping). In the research phase, the interns gained the experience of collecting different kinds of input from various stakeholders and developed a focused design brief through understanding the context around their projects. In the ideation phase, they developed various design solution ideas to explore potential solutions and evaluated those ideas according to their design briefs. In the detailing phase, the interns developed their idea further to address all aspects of their design brief and finalised the design solution. In the prototyping phase, they built prototypes of their solutions and developed communication material to convey their solutions addressing the sustainability issues defined in their briefs to industry partners. Throughout the internship, different learning tools were used:

- Four **masterclasses** on different topics were given. These classes focused on developing sustainability-related, as well as general design-related, competencies by experts in different areas.
- **Half-day workshops** were held by researcher/educators to help interns move forward when they had issues, or simply did not have enough expertise and knowledge.
A comprehensive list of available online educational resources was shared with the interns. The resources were categorized according to their strengths in different design process stages.

In addition to these tools, there were mandatory industry partner meetings scheduled in the brief (Table 1). The purpose of these mandatory meetings was to ensure client exposure and buy-in throughout the design process. Prior to the internship, researcher/educators held meetings with industry partners separately to develop the initial design briefs. Throughout the internship, industry partners were invited to UL for kick-off and presentations of outcomes. In addition, the interns were asked to meet with their industry partners for developing detailed design briefs and gathering feedback during design detailing stage.

While the above-mentioned meetings were scheduled and mandatory, the interns were encouraged to arrange regular additional meetings with their industry partners to gather feedback and move ideas forward. The right side of Table 1 presents ‘flexible’ meetings the teams arranged with their industry partners on their own accord. As can be seen, the appointments varied in nature for each industry partner, according to their availability, the progress of the internship projects and opportunities arisen throughout the internship (i.e. conference).

2.3 Interviews with Industry Partners

Nearly a year after the internship was completed, interviews with the three key contacts from each industry partner were conducted. The partners were sent the project reports ahead of the interview and encouraged to recap on both process and outcomes. The interviews were semi-structured and followed a previously prepared protocol around four main headings. Firstly, they were asked to recall their internship experience, looking back on their decision to participate in the internship, the process, changes in the direction of the project throughout the internship and the outcomes. Then, additional questions were asked to reflect further on their experience, including interesting aspects of the process, new knowledge acquired, working with novice designers and the role of UL throughout the process. Thirdly, they were asked if and how the internship affected their practices over the past year, in terms of the impact of the outcomes on their perception of sustainability, the way they conduct their businesses and unexpected results or unfulfilled expectations. Finally, their future plans were discussed about any potential shift toward sustainable businesses, as well as their collaboration with design departments and/or universities. The interviews took between 45 minutes to one hour and were audio recorded. Both researchers independently coded these recordings, using open codes and then compared their analysis to reach consensus. The coding revealed codes on assumed roles of industry.

Table 1. Industry partner exposure in relation to the internship structure

<table>
<thead>
<tr>
<th>Internship Stage</th>
<th>Mandatory Industry Partner Meetings</th>
<th>Flexible Industry Partner Meetings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation</td>
<td>- Researcher/educators for initial brief development</td>
<td>Mamukko, Kinsale One Off, Dublin SRWMO, Limerick</td>
</tr>
<tr>
<td>Research</td>
<td>- Researcher/educators and interns for kick-off and introductions - Researcher/educators and interns for research outcomes presentations</td>
<td>- Interns for workplace visits - Interns for workplace visits - Interns for workplace visits</td>
</tr>
<tr>
<td>Ideation</td>
<td>- Interns for preparing detailed design briefs - Researcher/educators and interns for the presentation of design ideas</td>
<td>- Interns for providing feedback on design ideas - Interns about additional resources</td>
</tr>
<tr>
<td>Detailing</td>
<td>- Interns for design detailing feedback</td>
<td>- Interns bi-weekly virtual meetings - Interns about attendance to a Start-up competition - Conference attendance with interns</td>
</tr>
<tr>
<td>Prototyping</td>
<td>- Researcher/educators and interns for final presentations</td>
<td>- Interns bi-weekly virtual meetings - Interns for copyright issues around the project</td>
</tr>
</tbody>
</table>

1 Existing, freely-available online educational resources were collated in a database on the website of Circular Design (L4IDS) project. The purpose of the database is to make many tools, techniques, methods and best practices related to design for sustainability visible and accessible to students, practitioners and educators. The database is open to everyone, and can be accessed through this link: http://circulardesigneurope.eu/oer/
partners, internship logistics, varying effects of outcomes, project scales and how they changed, adoptability of the outcomes, and limitations of the internship. The themes are discussed in the proceeding section.

3 Discussion- Internship Programme, Outcomes and Industry Partners

3.1 Collaborating with Universities Through an Internship Programme

This internship, in addition to being a unique experience for students with regard to its international nature and its direct focus on real-life innovations for sustainability and circular economy, also created a space for collaboration between industry partners and universities. The project briefs were centred on real-life challenges facing the industry partners, motivating them to actively participate in the process and to identify and exploit opportunities for sustainability. However, their levels of engagement varied, as well as their expertise on the project topic and perspectives on sustainability, affecting the roles they assumed in relation to the interns.

As illustrated on the right side of Table 1, the frequency of flexible meetings between interns and industry partners varied. For the Materials Exploration brief, the interns and industry partner worked closely, setting at least bi-weekly meetings (in addition to mandatory meetings) to discuss the project, give updates on each other’s activities, exchange ideas, and so on. For the Retrofitting brief, there were not any additional meetings scheduled except for a further feedback session right after the presentation of the ideation results. For the Preventing Food Waste brief, the nature of additional meetings was different compared to others and more steered towards expanding interns’ knowledge on food waste (i.e. conference) and exploiting alternative implementation routes (i.e. additional resources, attendance at a design competition).

The interviews revealed that the differences in engagement were also related to what industry partners expected to learn from the internship. For example, although Mamukko had the expertise in leathercraft and related design and production capacities, the challenge they were exploring with the interns (i.e. fishing nets, plastic reuse and recycling) required additional capacity building which they were hoping to get through collaborating with UL. Hence, they assumed the role of collaborating partners with the interns, as well as researcher/educators, and became more actively involved compared to other industry partners. On the other hand, SRWMO had a lot of expertise on food waste and projects around it and was aware of many real-life challenges on behaviour change. Working with novice designers, the representative in SRWMO assumed a mentor role, trying to inform interns and expand their knowledge around the food waste issues. One Off’s role, however, shifted throughout the process. They began as a collaborator working closely with the intern team to develop a new business model for their design consultancy firm. But, this role changed to that of a client, where One Off was providing feedback in the confines of their own focus on designing products and the interns were reconciling their work based on said feedback at specific stages. This shift in their role throughout the process confused the intern team, and whilst the partners were satisfied with the eventual outcomes, the process was not as smooth as the other two projects. The way these roles were adopted by industry partners indicates the importance of developing design briefs in facilitating knowledge exchange through such internship programmes.

3.2 Internship Outcomes and Long-term Impacts

At the end of the internship, the intern groups presented their design solutions to industry partners. They also prepared detailed reports outlining their design processes, user research and material testing conducted, production processes, prototypes, the ways they can be implemented in real life, and so on. These design solutions are summarised below.

- For Mamukko, the interns tested used fishing nets and explored ways of cleaning and recycling them within the capacities of the SME (i.e. their workshop), as well as opportunities of growing their business with sustainable products and services. The growth plan they presented included step-by-step business implications along with suggested product designs at each step and potential local collaborators (i.e. other businesses, institutions and NGOs).
- For One Off, the interns revealed the realities of implementing a take-back system within the limitations of a design agency. In addition to designing a product-service system for leasing high-end furniture and recovery, they also focused on how this system can be incrementally integrated into their existing business. This revealed challenges with regard to interaction with associated manufacturers and clients, as well as logistics, which they addressed throughout the implementation plan and an app to assist One Off’s fast-paced design processes.
- For SRWMO, the interns focused on resolving food waste issues in a more confined area (i.e. campuses) and designed a food sharing platform for students and staff, with the collaboration of on-campus businesses and the
management of UL. Although the user research and piloting were conducted in UL, they designed a toolkit for their solution so that it can be adopted by other universities in Ireland and around Europe.

What these outcomes indicate is that the solutions developed differed in scales from those outlined in the initial project briefs. For Mamukko, the design solution included the introduction of an ordinarily complex procedure (i.e. recycling) into the small-scale craft process – as a response to the initial design brief – but it also included solutions for the business to incrementally grow and become a significant actor in recycling fishing nets. On the other hand, the design solution for SRWMO was towards behavioural change in a more focused area (i.e. campuses) than initially intended by the industry partner (e.g. general public). However, these changes were decided upon with the industry partners throughout the process.

During the interviews, a clear positive emerged- all industry partners were partially utilising the outcomes of the internship after a year. Mamukko explained their intentions of growing their business with the help of the material experimentation completed by the interns, and they have been in touch with potential stakeholders including the ones they learned about from the interns. SRWMO talked about a fundamental shift in the way they were targeting their audiences, from addressing the general public and generally families to more niche groups e.g. students and campuses. They are currently developing a food sharing platform directly targeting these niche groups to be released nation-wide.

Contrarily, One Off emphasised that there are many aspects of the design outcome that requires “waiting for the right time and project” so that they could begin implementing the long-term integration plan the interns developed for the take-back system. In addition, they were overly stressing their existing limited human resources and capital, to simultaneously continue their business and prepare for this implementation, to which they are looking for alternative opportunities. They also mentioned that this challenge of transitioning towards sustainable business models is similar for many SMEs, as they require to work within their business model without disturbing their revenue stream while also implementing changes incrementally.

3.3 Limitations of Collaborating through an Internship Programme

Finally, the partners were asked what changes they would suggest for the remaining Circular Design internships and for any further partnerships between them and the University of Limerick. All partners agreed on one point with regards to the project logistics- they would have liked more time for the project, as they felt three months was too short. The scale of the briefs and the time required for the interns groups to become familiar with the area meant that the work only began to flow after several weeks. At this stage, the project was almost halfway through and the reality of completing a well-detailed design solution was not feasible.

Whilst the project would ideally be longer, allowing for deeper research and more evolved concepts to emerge, this unfortunately isn’t always possible. In addition to EU project restrictions on internship durations, academic calendars often misalign with industry timelines which can negatively affect the internship experience for all partners. Similarly, with all the interns returning to their home institutions to complete their studies meant the project couldn’t extend past the deadline even if there was scope in the concept for further development or even implementation.

Also, all of the partners expressed a desire to have continued communication with the intern groups in order to progress some or all of the concepts or simply give feedback on how related projects were progressing and how these were influenced by the internship outcomes. In some cases, this communication has continued but establishing a more long-term communication channel between all partners could be included in the future internships.

The partners also discussed that an ‘immersion phase’ at the start of the project would have helped speed up the familiarisation and research stage. Both One Off and Mamukko suggested that this could comprise a block of time (e.g. one week) placed in the company offices. This would ensure the interns really understood the business practices of the partners. While SRWMO suggested visits to similar initiatives and businesses to assess and review successes and failures. This immersion would also help to overcome the lack of real-world experience of the interns, which was expected by the industry partners but none the less commented on by all of them during the interviews. They perceived this as both a positive and negative; negative in how the interns were making simple mistakes that a more experienced group perhaps wouldn’t and that they lacked in-depth understanding of the mechanics of business. But positive in that they brought fresh perspectives to the problems the industry partners had been experiencing. The suggestion of a planned immersion period was brought forward to the subsequent internships to avoid similar issues arising again.
One final interesting topic raised by SRWMO was what type of industry partner would have the ability and the incentive to implement sustainable innovation in their practices. It was suggested that perhaps the private sector would be better positioned to implement real and tangible changes but that the public sector would need to support such changes through policy development, incentives and expert support. The Circular Design Internship has explored one such public sector initiative that engaged and supported private industry as they transition towards sustainable practice.

4 Conclusion

There is no denying the need for industry at all levels to move towards more sustainable innovation cycles and realise the SDGs (in particular SDG 12: Responsible Consumption & Production). However, what is needed are a variety of practical routes and vehicles for achieving this. One such approach is for higher education institutions to collaborate with industry, where the HEI shares their theoretical sustainability expertise and human capital (interns) and for industry partners to offer the business insights and pathway to production/implementation. It is clear from the first cycle of the Circular Design internship, that it is an effective means of creating collaborations that inculcate sustainability knowledge and build capacity towards sustainable innovation in SMEs across all partners. There are limitations, however, and the efficacy is in recognising these limitations and building on the positive aspects of this type of project.

This type of collaboration ensures novice designers are more knowledgeable about implementing sustainability and this will feed directly into their professional practice. This can be one of the only ways in which small companies can collaborate with larger academic institutions. Even though the projects were educationally based there were clear impacts on industry as the partners have all continued on with elements of the project and integrated the learning into their business practices. This can be attributed to the collaborative approach to creating the briefs, structuring the project and the implementation process.

The drive towards sustainability is a long road but initiatives such as this one can help towards realising the positive impact of design for sustainable innovation.

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