Shining a Spotlight on Innovation Practices in Privacy and Cyber Security

by Dr. Jamie Power

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Abstract

Rapid changes in technology infrastructure, the explosion of data, always-on-always-connected world, the emergence of "multiple internets" and escalating regulation and standards have and continue to offer fertile ground for innovation at product and service levels to increase ICT and personal security. Nonetheless, understanding of innovation management and practice remains fragmented, misunderstood and untamed by practitioners and researchers. Innovators operate within complex and turbulent environments, and are increasingly confronted with escalating and rapid technology developments, competitive global market competition and shorter product life cycles. While much information around innovation exists, the challenge of developing effective firm-level innovation practices, models and infrastructures underpins innovation endeavours. Based on the foregoing, this IPACSO Working Paper seeks to explore the innovation phenomenon at the firm-level through capturing innovation practices of a sample of the stakeholders[1] participating in the IPACSO project overall. This Working Paper draws upon the theoretical and empirical research presented in the IPACSO project deliverables available from the download section of the ipacso.eu website.

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This White Paper is produced as part of the Innovation Framework for Privacy and Cyber Security Market Opportunities (IPACSO). It draws partially on the material in the Reports D3.1 and D3.2. It does not reflect the opinion of RIKON-WIT as institution or IPACSO as consortium, but the author's own.

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[1] The stakeholder data represents a crosscutting sample of innovators and researchers, it does not purport to be statistically representative of the entire PACS spectrum.

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I. INTRODUCTION

While innovation is widely recognized by industry, policymakers and academics alike as a sustainable and competitive enabler, nonetheless understanding of innovation management and practice remains fragmented, misunderstood and untamed by practitioners and researchers. Reflective of this, innovation practice and requirements are far from straightforward. Indeed, varying attempts have been made to articulate conceptual order on the innovation processes of organisations, in the form of innovation process models. The variety amongst the models is the consequence of a lack of consensus as to how an innovation process should look like, given the unique requirements, contexts, environments, and purposes for which they are developed.

Taking the above into consideration, a pressing challenge facing the cybersecurity and privacy community is transitioning technical R&D into commercial and marketplace ready products and services - "*New and innovative technologies will only make a difference if they are deployed and used. It does not matter how visionary a technology is unless it meets the needs and requirements of customers/users and it is available as a product via channels that are acceptable to the customers/users*" (Maughan, et al., 2013). Based on the foregoing, developing an understanding of PACS stakeholders' innovation practices represents an integral and anchoring component of the IPACSO project overall, with reference to informing the development of appropriate and targeted support solutions. For this reason, and building on the outputs of IPACSO Deliverables D3.1 and D3.2, this working paper focuses on identifying stakeholders' innovation paths, scenarios and practices.

A broad range of stakeholder categories from varying organisational sizes are represented in this working paper, ranging from industry innovators in the PACS domain, research innovators, innovation intermediaries in the form of consultancy and industry support associations, in addition to funding and policy representatives. The following is a summary of the key take-outs.

Key Take-Outs

A diverse approach to organising innovation transcends the domain
A broad range of processes for organising innovation exist. Two thirds of respondents adopt a cross functional approach to facilitate innovation, a third utilise specialised organisation units (e.g. research centres). Over a quarter of respondents reported an ad-hoc, informal approach to innovation organisation and a further 16.7% identified that their innovation operations are conducted externally through outsourcing arrangements.

Multi-disciplinary internal and external stakeholder involvement
A wide-ranging spectrum of stakeholders are involved in innovation activities, albeit at varying levels. Internal staff represents the highest frequency of stakeholders used, followed by a combination of clients/customers, competitors, consultants are utilised at lower levels of frequency with professional/industry associations, universities and government/research institutes being used as less frequent partners.

Multiple and integrated innovation models are utilised
Demonstrating that innovation practice is a combination of technology push and demand pull dimensions, both of these categories are strongly represented amongst the respondents. Reflecting the previously reported dominant role of internal cross functional staff integration, a cooperative and parallel approach is also commonly pursued. Indicating a potential lack of innovation governance, only one in in five respondents reported a stage-gated process. Underscoring the escalating incidences of collaborations between innovating organisations and external stakeholders, over 50 % positive agreement statements were reported for systems/networking integration and open innovation models.

Product and service innovation are primary foci
Product and service innovation dominate primary innovation focus; whereas process innovation represents the key secondary focus. Conversely, organisational and marketing innovation was not reported as a focus by 50% and 40% of respondents respectively.

Innovation competency levels vary across the innovation value chain
The respondents identified high and competent levels of proficiency is the areas of ideation and concept development and design and business analysis. Regarding the concluding aspect of the innovation process, i.e. the launch, less than half of respondents utilise a multi-disciplinary team approach to ensure their innovation outputs are targeted, launched and delivered to the marketplace. Areas where respondents felt there was scope for improvement included the phases towards the end of the lifecycle including test, implementation and post launch.

Variance in innovation investment and performance
On average the greatest level of investment is directed in the early phases of the innovation lifecycle (ideation through to concept development); whereas less investment is directed towards the latter stages (test and implementation).

II. INNOVATION DEMOGRPAHICS

In pursuit of identifying PACS stakeholders' innovation requirements a mixed method triangulated research design was employed, encompassing an online questionnaire, semi-structured telephone interviews, secondary research, engagement with the Innovation Advisory Board and IPACSO Innovation Award finalists' innovators Reflecting IPACSO's multi-stakeholder foci, Table 1 illustrates that a diverse range of stakeholder categories are represented in the research project findings, ranging from industry innovators, research innovators, innovation intermediaries in the form of consultancy and industry support, in addition to funding and policy representatives.

Table 1 Respondent Categories

Respondent Category	Response Percent
Technology/Service Provider relevant to Privacy applications	39.1%
Cyber Security Technology/Service Provider	39.1%
Technology/Service Provider relevant to Cyber Security applications	30.4%
Research Group/Institute	21.7%
Privacy Technology/Service Provider	26.1%
Consultancy and Industry Support	30.4%
Funder or Investor	4.3%
Policy and Regulation	13.0%

PACS relevant subdomains include but are not limited to: mobile and cloud security, telco, cyber protection, cryptography, malware, privacy enhancing technologies, surveillance and intrusion detection, security intelligence, distributed computing and big data. Regarding organisation size, categories ranging from micro to large are represented with small organisations (34.8%) leading the response rate followed by micro (26.1%) and large (26.1%) and medium size organisations (13%) respectively. The data reflects the growing consensus placed upon small firms proliferating the diverse and fragmented PACS landscape, with small and micro firms accounting for over half of all participants in the research. Reflecting the diverse category of organisational personnel involved in innovation processes, participation from all areas within organisational structures participated in the requirement gathering research. More specifically, respondents included: founders and directors, R&D managers and personnel, CTO's, commercial directors and business developers, CEO's, project and product managers, technology transfer managers, professors and researchers from research institutes, policy makers and security evangelists.

Having identified the stakeholder categories of interest, the following sections serve to provide a holistic end-to-end exploration of the practices across the innovation lifecycle environment and components. As documented in D3.1, varying attempts have and continue to be made to articulate conceptual order on the innovation processes of organisations and the variety amongst such models is the consequence of a lack of consensus as to how an innovation process should look like, given the unique contexts, environments, and purposes for which they are developed.

III. Innovation Environment and Ecosystem

Several authors acknowledge that innovation process does not occur within a vacuum, and thereby indicate a range of contextual factors which impact on the processes deployed (Rothwell, 1994); (Van de Ven, et al., 1989); (Cormican & O'Sullivan, 2004); (Tidd, et al., 2005). Such contextual factors range from organisational characteristics to societal factors and from influenceable factors to external factors. While two thirds of respondents indicated that an innovation strategy(s) is in place in their organisation, the survey revealed that there are variances in terms of supporting and complementary policies and procedures underpinning such strategies (Table 2).

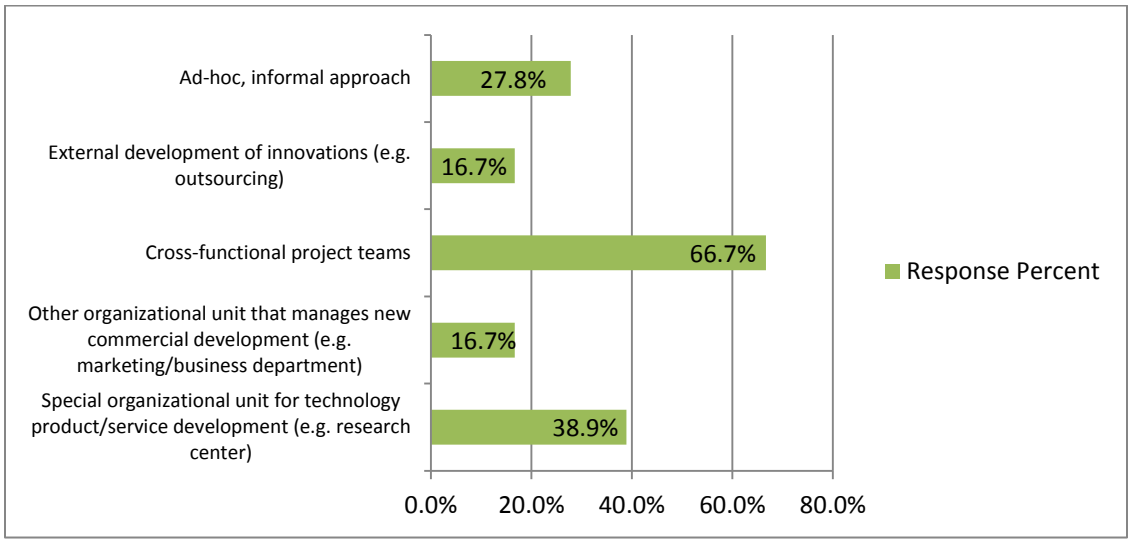
Table 2 Innovation Strategy within Responding Organisations

Innovation Strategies, Policies and Procedures	Response Percent
Yes, there is a strategy	66.7%
No, there is not a strategy	5.6%
Yes, to supporting policies and procedures	11.1%
No, to supporting policies and procedures	16.7%
Yes, we have both a strategy and supporting policies and procedures	22.2%

Reflecting the degree of variance underpinning innovation organisation and management within the literature base, a broad range of processes for organising innovation were collected from the respondents (Figure 1). Two thirds of respondents adopt a cross functional approach to facilitate innovation, a third utilise specialised organisation units (e.g. research centres). Of note, over a quarter of respondents reported an ad-hoc, informal approach to innovation organisation and a further 16.7% identified that their

innovation operations are conducted externally through outsourcing arrangements.

Figure 1 Means of Organising Innovation



Turning to the personnel involved in innovation activities within the responding organisations, the results indicate that a wide-ranging spectrum of stakeholders are represented. Unsurprisingly, internal staff represents the highest frequency of stakeholders used. A combination of clients/customers, competitors, consultants are utilised at lower levels of frequency with professional/industry associations, universities and government/research institutes being used as less frequent partners. A significant proportion of respondents indicated that external stakeholders such as suppliers, competitors and consultants are never involved in the innovation processes or activities within their organisation.

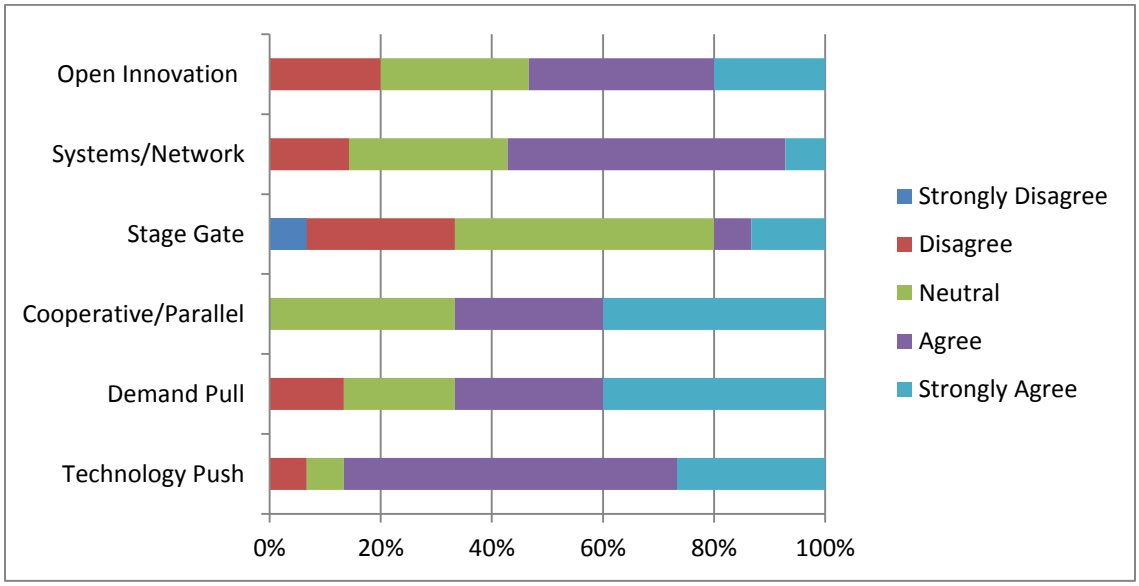
IV. Innovation Models and Focus

Understanding of the process of innovation at the firm-level has evolved throughout recent decades from simple linear and sequential models to increasingly complex models embodying a diverse range of inter and intra

stakeholders and processes (for a more detailed description see IPACSO D3.1).

Echoing the sentiments of (Rothwell, 1994) innovation generation classifications, it is not uncommon for multiple features of innovation evolutions/models to be reflected in a particular overarching innovation framework, as reflected in Figure 2. Demonstrating that innovation practice can encompass both technology push and demand dimensions, both of these categories are strongly represented amongst the respondents. Reflecting the previously reported dominant role of internal cross functional staff integration, a cooperative and parallel approach is also commonly reported. Indicating a potential lack of innovation governance, only one in in five respondents reported a stage gated process. Underscoring the escalating incidences of collaborations between innovating organisations and external stakeholders, over 50 % positive agreement (strongly agree + agree) statements were reported for systems/networking integration and open innovation models.

Figure 2 Respondents Innovation Model Classification



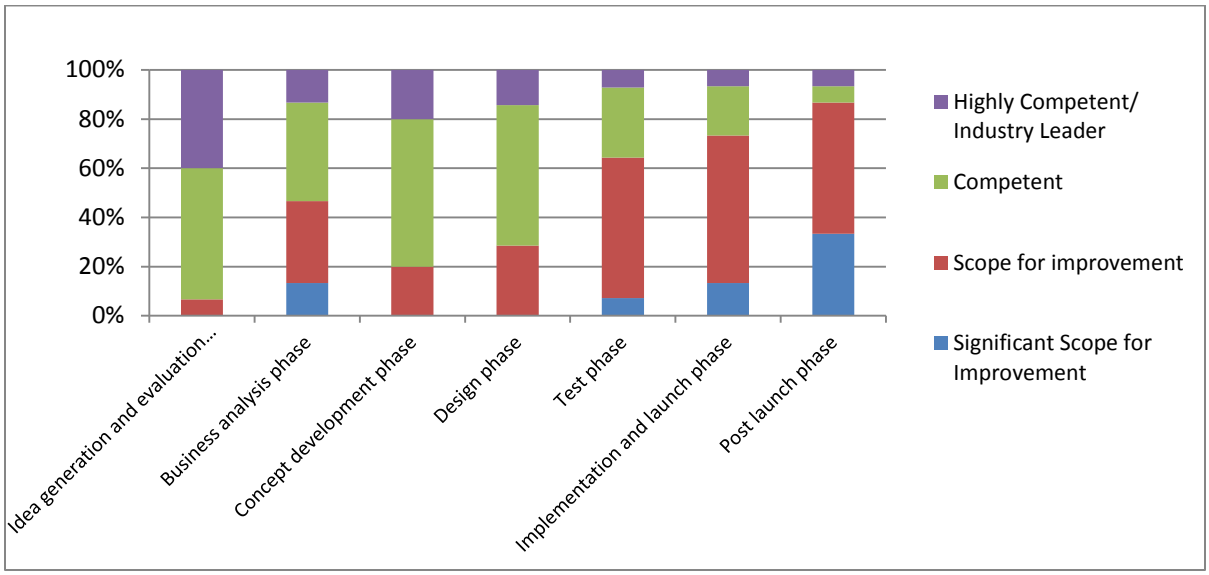
As reported in D3.1, a considerable literature base has accumulated on the subject of innovation. The corpus of literature on the categories of innovation illustrates a vast array of innovation types transcending product, process, service, people, technical, administrative, incremental, hybrid and radical dimensions. In terms of the respondents to this study, product and service

innovation dominate their primary innovation focus; whereas process innovation represents the key secondary focus. Conversely, organisational and marketing innovation was not reported as a focus by over 50% and 40% of respondents respectively.

V. Innovation Lifecycle Competnecy & Practices

An extensive corpus of literature has accumulated documenting the range of end to end phases relating to innovation processes. All models start with some form of idea generation/ searching and selection stage, followed by a development phase where the idea is developed into a tangible product, process or service and culminates in implementation/launch typically entails marketing, distribution, logistics and customer facing activities. (Eleveens, 2010) synthesized these phases ranging from idea generation through to implementation. When asked to rate their level of competency across the various phases of an innovation lifecycle (illustrated in Figure 3), the respondents identified high and competent levels of proficiency is the areas of ideation and concept development and design and business analysis. Areas where respondents felt there was scope for improvement included the phases towards the end of the lifecycle including test, implementation and post launch.

Figure 3 Innovation Competencies across Lifecycle Phases



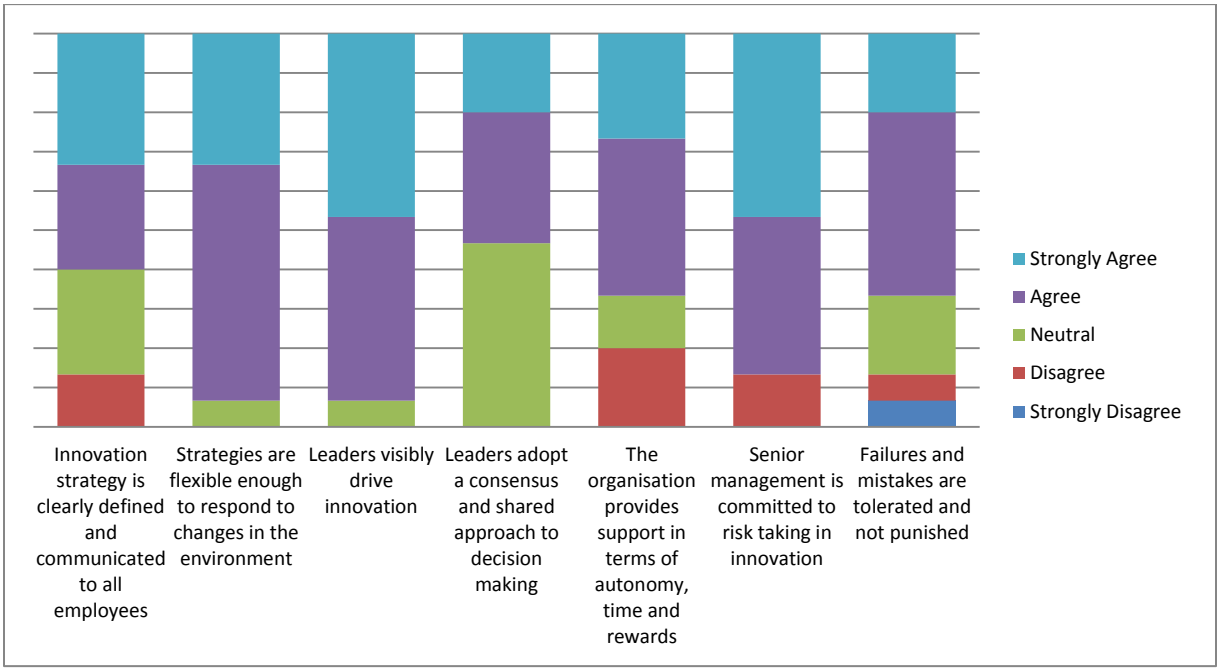
Cognisant that innovation performance does not occur within a vacuum, the literature base identifies a range of organisational strategy, environmental and contextual factors which impact on the processes deployed (Cormican & O'Sullivan, 2004); (Tidd, et al., 2005). The AT Kearney House of Innovation model, which underscores the European Commission's IMP³rove programme maps such innovation lifecycle and organisational/contextual factors (Figure 4).

Figure 4 Kearney House of Innovation

Source: A.T. Kearney 2006 – available at: www.improve-innovation.eu

In terms of the innovation strategy and culture of the respondent organisations (Figure 5), the overall reported consensus is positive. More specifically, 60% of respondents positively indicated (strongly agree + agree) that their innovation strategy is well defined and communicated. Moreover over 90% positively reported that their innovation strategies are flexible to respond to environmental changes. Turning to culture, a strong leadership for innovation was documented and equally, three quarters of respondents signalled that a supportive and risk taking ethos underpins this.

Figure 5 Innovation Strategy and Culture

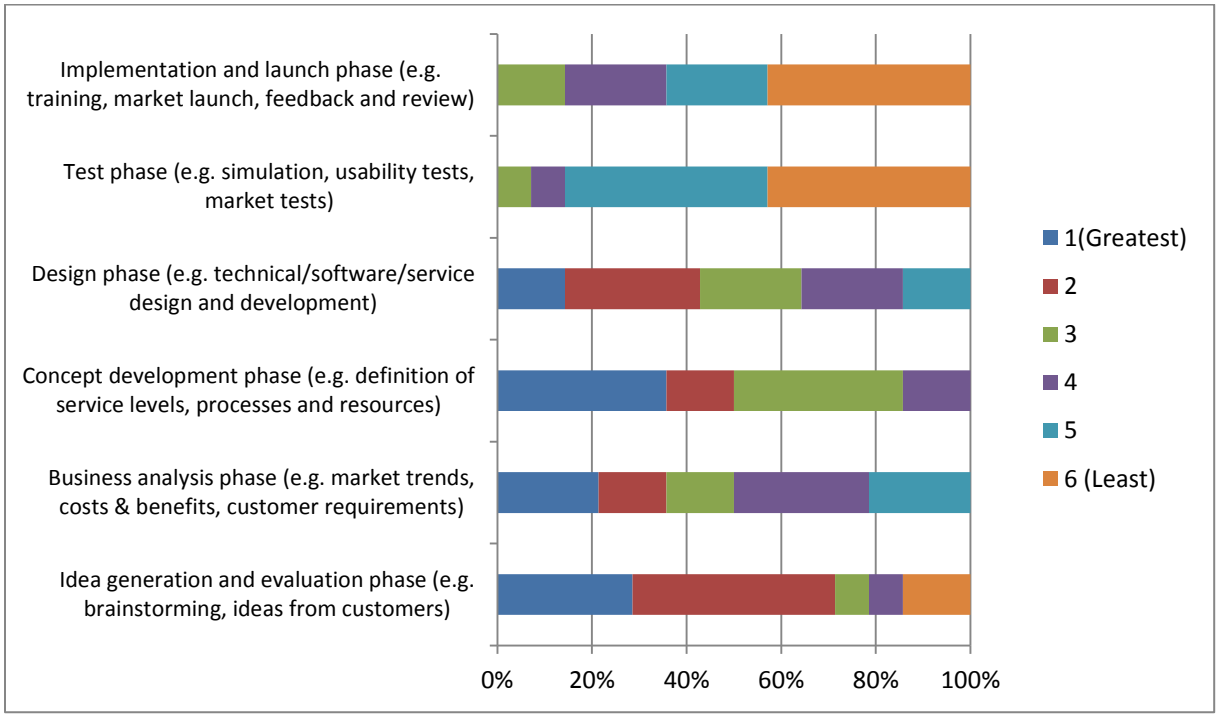


Turning to the more practical elements of innovation planning, section and management the respondents innovation practice, six out of ten responses indicated that innovation projects are selected according to defined criteria and a similar percentage reported the incidence of pre-development feasibility and market studies. Less positively, a fifth of respondents disagreed that their organisation achieves balanced portfolio management. Furthermore, over half of all respondents identified that less than adequate resources are available or committed to realizing innovation goals.

In exploring the ideation to launch journey and experiences, the findings indicate that respondents disagreed (60%: combination of disagree + strongly disagree) that formal ideation processes incorporating multiple sources were deployed. Echoing this finding, a similar level of disagreement was reported in relation to systematically collecting/evaluating marketing, technology, competitor and business intelligence. On a more positive note, almost 80% of respondents identified that their development processes are flexible enough to be adapted to market conditions and project reports. Indeed, over half of responses identified that lean and agile approaches are followed for innovation development. Regarding the latter aspect of the innovation process, i.e. the launch, less than half of respondents utilise a multi-disciplinary team approach to ensure their innovation outputs are targeted, launched and delivered to the marketplace.

Respondents rated the level of investment their organisation places across a range of phases in the innovation lifecycle on a scale from 1 to 6 (1=greatest level of investment and resources - 6=least level), the results of which are presented in Figure 6. As can be seen, the greatest level of investment is directed in the early phases (ideation through to concept development) of the innovation lifecycle; whereas less investment is directed towards the latter stages (test and implementation).

Figure 6 Level of Investment across the Innovation Lifecycle



VI. Concluding Observations

The IPACSO initial findings indicates a diverse and varied perspective of innovation organisation and practice in the PACS domain:

- Multiple and integrated innovation models are utilised which draw upon elements of technology push, demand pull, cooperative, networking and open innovation principles. This variance, creates

different scenarios of practice and focus both in terms of the stakeholders involved and the phases/gates deployed and in turn, their requirements. Moreover, the level of innovation practice and requirements of innovators varies depending on their respective maturity level.

- At a high level, the research indicates that existing competencies and investment are directed in the early phases of the innovation lifecycle (ideation through to concept development); whereas significant scope and requirements occur in the latter stages (test and implementation).
- A significant finding is that innovation challenges transcend infrastructural, market, knowledge, cost and legal domains. Cost factors came first for all the respondents with knowledge and market factors also representing a serious problematic innovation challenge. While market shifts and demands represent a key innovation component and driven in any industry setting, the constantly changing and hard to predict PACS environment exerts a significant challenge.
- The stakeholders identified a broad innovation requirements and related scope for innovation supports across the entire innovation value chain and ecosystem (i.e. strategy, business intelligence, ideation, portfolio management, resource management development, and launch). A common denominator from the interview findings is the varying levels of disconnect between research and technology development and innovation diffusion/implementation. While the imperative of underpinning innovation development activities with sound commercial business cases was recognised by all, competency and proficiency in this area varies significantly.

Table 3 Synthesis and Key Take-Outssynthesises the key findings gleaned from the exploration of PACS innovation practices within the sample of innovators who engaged with the IPACSO project.

Table 3 Synthesis and Key Take-Outs

No "one size fits all" solution	• Too many variables impacting on the innovation value chain/ecosystem for one 'grand' framework. Models and pathways represent the "ingredients not the recipe"
Consensus on phases/stages	• End-to-end phases: ideas → launch • Vast knowledgebase to inform firm-level innovation practice: i.e. models and stages involved; considerations for R&D, utilizing both internal and external knowledge sources/collaborators and responding to market forces.
Related ecosystem	• Integration between the different functions (internal) /contexts (external). • Innovation is more than the technical product/service output: infrastructural, ecosystem, and 'soft' people related initiatives: • Actions to ensure a balanced innovation support offering
Networked and Open Innovation	• Fragmented PACS market /supply chains presents fertile opportunities: • Supports/measures for encouraging, incentivising and facilitating collaboration (cross-functional).

Competencies	• Strong in the early phases of the innovation lifecycle; significant scope and requirements for intervention/support exist in latter stages; maturity level exerts influence.
	  • Skill shortages on both technology and commercial sides.
	  • Supports across the entire innovation value chain:
	  • i.e. innovation action instruments (feasibility/business case) through to commercialization programmes.
	  • Engaging with end-users (testing/validation etc.) early in the innovation process.
	  • Networking and collaboration facilitation

Given the diversity reported, it is clear that innovation practice and requirements are far from straightforward and there is no one-size-fits-all solution or panacea.

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