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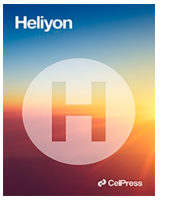

Research article

Examining the benefits, challenges, and drivers of open user innovation in small and medium-sized enterprises operating in low R&D industries

Mana Alyami [a], Muhammad Faisal Javed [b,*], Ahmed WA. Hammad [c,d], Assed Haddad [d]

[a] Department of Civil Engineering, College of Engineering, Najran University, Najran, Saudi Arabia
[b] Department of Civil Engineering, Ghulam Ishaq Khan Institute of Engineering Sciences and Technology, Topi, Swabi 23640, Pakistan
[c] Macroview Projects, Sydney, Australia
[d] Programa de Engenharia Ambiental, Universidade Federal do Rio de Janeiro UFRJ, Rio de Janeiro, 21941-901, Brazil

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ABSTRACT

Recent studies have indicated that many challenges exist in implementing open user innovation in SMEs. As a more advanced paradigm of traditional innovation, open user innovations are developed by users and other stakeholders who share tasks and costs of innovation development and then freely unwrap results. The work presented in this article examines the main factors driving open user innovation in SMEs, operating in industries with low investment in R&D. The work accounts for differences in the economics categorisation of the countries in which the organisations operate in (developing vs developed), and how that impacts various factors related to open user innovation adoption. The findings of this study indicate that differences between Australian and Kuwaiti SMEs exist, in terms of perceptions of success, benefits, challenges, and ease of implementation related to open user innovation. In addition, some differences are observed in the drivers for sensing open user innovation opportunities between the two countries examined.

1. Introduction

In the wake of the tremendous challenges that businesses and organisations face in the global economic and political setting, there has been a need for a reformulation of innovation strategies adopted by firms. Innovation management in its traditional form with reliance on internal sources mostly resembled in isolated Research & Development (R&D) department, no longer provides organisations the means to face the looming impacts of globalisation, economic downturns, and rapid competition [1]. Instead, and as was proposed by Ref. [2], there is a need for organisations to open up their R&D approaches, making use of external along with internal sources. Open user innovation presents an avenue for firms to extend their corporate advancement, through the exercise of external networks, knowledge, and cross-boundary collaborations. This however does come at a cost, particularly in terms of opportunity sensing, adoption strategy, implementation methods, and barriers to seizing opportunities identified for open user innovation [3].

* Corresponding author.
E-mail addresses: mmsalmansour@nu.edu.sa (M. Alyami), arbabfaisal@giki.edu.pk (M. Faisal Javed), Ahmed.Hammad@poli.ufrj.br (A.WA. Hammad), assed@poli.ufrj.br (A. Haddad).

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In terms of open user innovation adoption, a challenge exists in combining the methods that organisations need to implement in order to leverage external courses of knowledge in their innovation strategies, while resisting the natural barriers inherent in an open innovation development system [4]. These barriers stem from several factors that are related to the sensing and seizing opportunities that firms adopt towards open innovation, including the economic growth of the country in which the firm is located, the nature of the industry in which the firm operates, and the size of the firm [5–7]. Small and Medium-sized Enterprises (SMEs) are characterised by having greater flexibility and higher capacity to adapt to changes in the market, along with higher innovative capacity [8] this can be advantageous in terms of the adoption of the open user innovation scheme by SMEs, though their financial and organisational structure, along with their reluctance to take on risk can be an issue in terms of seizing open user innovation opportunities [9]. Adoption of open user innovation by SMEs, and the associated barriers that they face during the opportunity seizing and implementation phases, is a topic that has not received enough attention in the literature [10], even though many pioneering works state the significance of SMEs in innovation [11,12].

Open user innovation offers a new paradigm to SMEs where reliance is mostly on external sources for innovation, rather than internal sourcing that some SMEs might find difficult to attain. Existing literature tends to cover the developments in high R&D industries [9], with less focus placed on the issues of open user innovation in SMEs that operate in low R&D industries [13]. In addition, there seems to be no consensus among the scholars on the impacts that the openness of the firm has on its performance [14].

In order to close the gap in the literature, the main contribution of this paper is to assess the drivers, benefits, and barriers associated with the implementation of open user innovation in SMEs that operate in low R&D industries. This assessment is done by investigating open user innovation opportunities and challenges that face SMEs in the construction, retail, and agriculture industries. Emphasis is placed on examining the differences experienced in SMEs operating in developed *vs* developing countries when it comes to identifying open user innovation opportunities. To support the research objective underlying this study, data is collected from SMEs operating in: i) Australia, a country whose economy is considered to be developed; and ii) Kuwait, a developing country. Results obtained from both countries were analysed via adoption of a quantitative research methods approach which is based on correlation testing, factor analysis, and multiple linear regression. The analysis enabled a better understanding of the impact of open user innovations adopted in the SME on the organisation's success, usefulness of the open user innovation to the organisation, and challenges faced by organisations in adopting open user innovation.

The paper is organised as follows; in the next section, a literature review of methods for open user innovation in SMEs is conducted. The following part of this paper then presents the research method adopted, the data collection approach utilised, and the data analysis implemented. Results of the empirical research carried out in Kuwait and Australia are then discussed. Concluding remarks are finally presented at the end of the paper.

2. Literature review

The role of R&D investment in firms has been recognised worldwide. Back in 2010, the European policy strategy had stipulated that Europe would become the most dynamic knowledge economy in the world, through inciting extra investment in R&D [15]. Policy advisers have strongly propagated the notion that the achievement of the European policy strategy relies on R&D investment within SMEs [16]. Investing only in R&D however, is recognised as no longer sufficient to allow for an effective management of innovation, with firms now focusing on the market and its customers for input [17]. Doing so provides an opportunity to assimilate external ideas with the internal innovation system [18]. In addition, challenges associated with internal R&D, including the scarcity of resources, ill access to up-to-date scientific knowledge, and the complexity of the scientific field can be overcome by the adoption of open innovation as a means for extending the technical competence of a firm [19].

Open innovation is commonly discussed as an emerging strategic decision in the innovation literature [20]. Over 3600 articles have been published ever since the inception of the concept back in 2003 [14]. A characteristic that differentiates open innovation from traditional innovation is the emphasised focus on the market and customers (clients) involved. In open innovation, useful ideas from internal sources to the organisation (e.g. internal paths to market, selling IP, and knowledge to others), along with external sources (customer, competitors) are integrated to accelerate the development of new products [21].

Initial attention in the open user innovation literature was on large firms; as an example, IBM, and P&G have enforced active external engagement with customers, suppliers, and leading scientists as part of their innovation management strategies [22,23]. IBM has also commercialised on inside intellectual property [24]. Works of Spithoven et al.; however, indicate that SMEs have a more significant absorption capacity of open innovation, in comparison to the big firms [6]. SMEs account for a large portion of the economic growth in a particular nation [25]. This also supports earlier work by Schumpter which states that SMEs are a leading source of most innovations [26], though when it comes to closed-form innovation, the high capital required for investments in R&D and the need to take on risk may deter many SMEs from engaging in the internal form of innovation [27,28].

The innovation model adopted by SMEs differs from the one assumed by large firms. The innovation procedure of SMEs is typified through its flexible and faster decision-making process, given the fewer resources that are available for R&D [28,29]. In that sense, SMEs tend to compensate for their inability to cover the investments needed on activities that successfully translate into an innovation, via making use of alliances external to the business, along with inter-organisational reach [29]. When examining the literature on open innovation and its adoption by SMEs, it is apparent that SMEs are more inclined to utilise activities that have low to no monetary costs, for achieving the open user innovation. This includes the preferences for knowledge sourcing via networking, rather than implementing activities that are resource-intensive and which require complex transactions [28]. This again highlights the capital limitations of the SMEs' capacity to engage in traditional R&D [30]. The same principle applies to SMEs operating in low R&D, where their restricted access to resources and substantial finances for conducting internal R&D projects can limit their internal innovation capacity

[31].

A categorical system agreed upon in the literature is whether the open user innovation is in-bound or out-bound [22]. An inbound open innovation aims to capitalize on the company's knowledge through the acquisition of externally developed technologies and open exploration mechanisms. As a result, firms tend to leverage outside knowledge from suppliers, customers, and research bodies, in an attempt to upscale the visibility of their knowledge capital [32]. Outbound open innovation involves the outward transfer of technology, via some sort of commercialisation of exclusive knowledge [33]. Another pathway for achieving openness in innovation involves the use of a coupled process where both inbound and outbound activities are utilised, in cooperation with a network consisting of other external firms [34].

Within external knowledge sourcing, a list of key sources has also been discussed by Ref. [10] for categorising the type of open user innovations that SMEs tend to engage in. These span external innovation partners, including direct and indirect customers [35], supplier interactions [36], interactions with research bodies and organisations [37], interactions with experts/consultants [38], and interactions with competitor and partner organisations [39]. SMEs are also known to communicate with other SMEs in what can sometimes be an extensive external and social network [40]. For the implementation of open user innovation, there is a need to constantly engage with external sources to initiate and establish new ideas [41]. Several factors can impact the association of SMEs with such activities. In particular, SMEs cannot afford to expend large amounts of time and money to establish such external relationships [28,29]. Even after sensing external opportunities for open user innovation, SMEs find it difficult to internalise on the externally acquired knowledge due to lack of an internal knowledge base [6].

Even though innovation is considered as a suitable means for the growth of national economies [42], countries that have led national initiatives and campaigns to try to drive as many SMEs to adopt various sorts of innovation are yet to reap the benefits. In particular, developing countries face an extensive realm of challenges when it comes to external collaboration with partner-enterprises, consultants, and inventors [7]. This is mostly due to the increased financial pressures and lack of resources when contrasted with developed countries [43]. SMEs in developing countries are warier of the choice of external partners since they have fewer opportunities to reel back from a failed venture, in contrast to their counterparts in developed countries [44]. Cooperative strategies are thus rarely exercised in developing countries, resulting in a small number of integrated business processes between SMEs [45]. The technology asset of SMEs in developing countries is also lower than that of developed countries, making it difficult to keep up with constantly evolving external knowledge generated from an ever-evolving market [44]. There is also the lack of strict legal enforcement of contracts in developing countries generally, making external partnerships with competitors and other firms challenging [7]. The quality of knowledge emanating from universities and research institutes operating in developing countries is deficient to that of developed countries [6].

Constantly keeping track of the progress of external partners is essential for ensuring that sensing opportunities of open innovation epitomise [46]. Lack of resources in SMEs means that the maintenance of the external network can be somehow difficult [47]. This also deters external actors from associating with SMEs, knowing that their efforts risk being not transformed into positive value [48]. The lack of the means for SMEs to commercialise on novel ideas and products generated out of the open innovation is more prominent in developing countries, in contrast to developed countries [29]. Given all these challenges that SMEs in developing countries face when implementing open user innovation, one possible approach to incentivise SMEs includes support from the public sector, in the form of government schemes and policies [49,50].

Recent studies on open innovation are presenting new visions, applications, and profiles. From behavioural innovation [51], to ethnographic narratives [52], the human perspective is explored and discussed. Other authors direct their attention to the technological aspect, highlighting the barriers and difficulties [53] in the implementation of user-developed products. Some studies describe the role of universities [54] in helping implement the innovation strategy in SMEs. Guertler and Sick [30] present a Situational Open Innovation framework that provides methodical support for SMEs and allows partner search and selection in open innovation projects.

From the literature review conducted, there is an apparent gap in terms of drivers, benefits, and challenges associated with open user innovation when considering low R&D-industries where SMEs operate in. Key drivers to the innovation and differences between a developed and a developing country are identified and examined, to enable a better understanding of the role of open user innovation in low R&D industries.

SMEs that have the capacity to rely on an extensive external network for their innovation are more likely to succeed in collaborating with these external agents to produce innovations that are beneficial and which can be commercialised [28,41]. Therefore, the *first hypothesis* is SMEs operating in low R&D industries, in countries that are economically developed are more motivated to build external networks and commercialise on external ideas and knowledge through strong communication systems with external partners, in contrast to their counterparts in developing countries. This builds on the work of [7], indicating that the economic development of a country influences the degree of innovation and innovation ecosystem adopted by organisations operating in that country.

[49,50] indicate the need for supporting policies from government agencies to motivate the creation of open user innovation opportunities by SMEs operating in low R&D industries. The *second hypothesis* is therefore: SMEs operating in low R&D industries, in developed countries, are more likely to effectively make use of open user innovation given the support they receive from advantageous public policies enforced by the government to entice the adoption of open user innovation schemes, in contrast to their counterparts in developing countries.

Generally speaking, SMEs are assumed to engage in very little R&D due to a large amount of capital required to be invested, which is costly for small businesses [30]. In addition, there exists a significant number of SMEs that operate in industries that are characterised by having a low investment in R&D, including the construction [55], retail, and food production industries [56]. The influence of R&D on the adoption of open user innovation in SMEs has been explored in Ref. [54]. SMEs operating in developed countries are found to engage more in R&D, in contrast with their counterparts in developing countries [54]. Such research engagement is often built

via the association and collaboration with research institutes, as indicated in Ref. [34]. SMEs can benefit for an enhanced drive for open user innovation if this is achieved via a collaboration with an external research institute to set the main steps and process to undertake. The *third hypothesis* is therefore set as follows: SMEs operating in low R&D industries in developed country are more likely to utilise research agencies as external agencies to drive their open and user innovation scheme, in comparison to their counterparts in developing countries.

The contributions of this study are.

- Assessment of the key drivers that lead to sensing and seizing opportunities of open user innovation by SMEs operating in a representative developed and developing country.
- Understanding the impact of open user innovations adopted in the SME on the project's success, usefulness, and challenges.

The central *research question* that will be answered in this research is as follows:

"What are the differences in open user innovation methods that are utilised by SMEs operating in low R&D sectors, in developing and developed countries, and what are the main drivers that instigate the sensing opportunity for open user innovation in the latter countries. What is then the impact of the drivers on the success of the implemented open user innovation scheme in each country, and what are the associated challenges of implementing the innovations identified".

The empirical evidence gathered is a result of a survey of 220 SMEs operating in low R&D industries, located in Kuwait (developing country) and Australia (developed country) More information is provided on the survey in the next section of the paper.

3. Research method

3.1. Overview of method

This research explores the impacts of the open user innovations adopted by SMEs in developing and developed countries on success criteria and challenges faced by the SMEs, and the different main drivers that contribute to the sensing of opportunities for open user innovation. An extensive literature review was conducted to provide an overview of open user innovations adopted by SMEs. A list of key drivers that are of importance to the SMEs in developed and developing countries when it comes to open user innovation adoption was developed. The research method adopted in this study relies on the collection of data via a questionnaire, and later the analytical survey of the collected data via use of correlation testing, factor analysis, and multiple linear regression, to examine the relationship and significance of the modelled variables.

3.2. Data collection and analysis

A total of 356 SMEs in each country were asked to fill a survey, of which 110 in each country were analysed. The developed questionnaire comprised of 26 closed-ended questions, that capture: i) the key drivers that permit SMEs in both countries to sense and seize opportunities of open user innovation; ii) the success of the innovation; iii) the usefulness associated with the open user innovation; and iv) the challenges associated with the innovation. Nonresponse bias was examined, taking into consideration geographic distribution and organisation size [57]. Stratified random sampling was adopted in this study, ensuring eligibility of participants based on their organisation's profile. Common method bias was avoided by adopting the following ex-ante techniques.

- Using two or more information sources to gather data.
- Data collection at different points in time.
- Ensuring that the wording of the questions is clear and concise;
- Ensuring that the order of the questions are mixed and adopting different scale types for the questions.

Table 1
Classification scheme of SMEs in this study.

Classification			
		% (Total)	
Firm industry classification	Construction (Design and Contracting)	38	
	Retail	37	
	Agriculture	25	
		% in Kuwait	**% in Australia**
Number of employees (classification according to [9]	Micro firms (< 10)	18	17
	Small firms (≥ 10 and < 50)	59	51
	Medium firms ((≥ 50 and < 250	23	32
Age of firm in years (classification according to [9]	< 5	3	7
	≥ 5 and < 15	43	51
	≥ 15 and < 30	39	32
	≥ 30	15	10

As a post-hoc procedure, Harman's single factor test was used to confirm that common method bias did not exist.

The quantitative analysis conducted in this study is composed of a statistical analysis, performed using the Statsmodels library in python [58]. The respondents surveyed were all at the managerial level, to ensure that perceptions of key decision-makers in SMEs were captured. In addition, the respondents were categorised according to the particular industry in which they operated, the size of the firm, and the age of the firm, in both Kuwait and Australia, Table 1. The analysis was conducted to try to gather as much information as possible from a diverse range of low R&D industries operating in both countries.

Table 1 indicates that the majority of the respondents involved come from firms that would be classified as belonging to the construction or retail industry, both are known to be low R&D industries [59,60]. The respondents were nearly equally divided between the two countries. Most responses came from small firms with more than 10 employees and less than 50 employees, under the classification specified by Ref. [9]. For both countries, most of the firms were operating between 5 and 15 years.

3.3. Questionnaire design

Closed questions were utilised to construct the questionnaire adopted in this study. Based on the literature review conducted, a set of sources that represent open innovations adopted by SMEs was identified. The questionnaire centred upon the general nature of the firms, the nature of the open user innovation adopted, i.e. whether it was an outside-in process (inbound), an inside-out process (outbound), or a coupled process [23], the usefulness of the adopted innovation to the SME, and the challenging factors associated with open user innovation adoption.

The survey's initial section asked participants to evaluate the success of the company's open user innovation approach, specifically its ability to identify and capitalize on new opportunities, using a Likert scale. Table 2 displays the dimensions of *success* of the open user innovation (*IS*), along with the observed features of each dimension. The first dimension, *innovation success*, is a general measure of how respondents perceive the success of the sensing and seizing approaches adopted by a firm for open user innovation. The second dimension is related to the impact that the adoption of the open innovation had on the firm's *performance* [47], denoted *OP*. The third dimension is related to how well the firm has managed to achieve its *desired outcome* via adoption of the open user innovation [61], denoted *DP*. The last dimension which assesses the *usefulness* of the open user innovation adopted by the firm, relates to how much *competitive advantage* is perceived to have been gained over competitors of the firm under examination [62], denoted *CA*. Respondents were also required to identify the *challenges* associated with open user innovation. Three dimensions assess the challenges measure, namely, the *impact on budget* (IB) [63], the *impact on output* (IO) [33], and the *ease of implementation* of the open user innovation (EI) [28], displayed in Table 2. All were assessed using a Likert scale.

In the second part of the questionnaire, the respondents were asked to identify the main drivers that they believed were significant when it came to the sensing of open user innovation opportunities. The main drivers of innovation for open user innovation listed in the questionnaire were identified from the literature; the drivers are displayed in Table 3. A five-point Likert scale was adopted in the questionnaire, given it being readily comprehensible by respondents, hence increasing response rate [69].

4. Data analysis

The data analysis process utilised, once all the necessary data was made available, can be summarised as follows. First, heteroskedasticity is not present in the data, using White's test. Next, Pearson's r bivariate correlations test was performed on the variables, assessing *usefulness* and *challenges* of the open user innovation [112], Table 4. The results indicated a relatively high correlation between the items capturing *usefulness* and *challenges* of open user innovation, making the sample a good candidate for factor analysis. A statistically significant linear relationship exists between the variables assessing the key drivers of the open user innovation. In most instances, the correlations are significant at the 0.01 level (for a two-tailed test). An association between all modes of open user innovation adopted in both Kuwait and Australia is thus clear. Factor analysis allows modelling the interrelationships between the measured dimensions via fewer latent variables [113]. A data reduction technique is thus implemented to assess the validity of the perceptual scales adopted, through capturing the variance in the measured variables for *usefulness* and *challenges* of the open user

Table 2
Benefits and Challenges of open user innovation.

Rate how much you agree with the following			
Latent variable	**Measured dimension**	**Measured dimension notation**	**References**
Success	Innovation was successful (likert scale). Success here means that the open user innovation was implemented at the organisation, and a positive outcome to the organisation was obtained due to the adoption of open user innovation.	IS	[47,64]
Usefulness of the open user innovation to the overall organisation	Satisfactory organisation performance	OP	[47,65,66]
	Desired outcome reached	DO	[61]
	Competitive advantage over competitors	CA	[62,67]
Challenges of adoption of the open user innovation	Impact on Budget was positive	IB	[63]
	Impact on output was positive (likert scale)	IO	[33]
	Ease of implementation	EI	[28,68]

Table 3
Drivers of open user innovation.

Please rate from 1 to 5 how much you agree that the open user innovation adopted was driven by …		
Main driver	**Explanation**	**References**
M1	Involvement of clients on a regular basis for sharing their ideas as to how the business can become more effective	[70–77]
M2	Involvement of suppliers/subcontractors on a regular basis for sharing their ideas as to how the business can become more effective	[10,36,71,78]
M3	Involvement of consultants on a regular basis for sharing their ideas as to how the business can become more effective	[6,7,79,80]
M4	Involvement of external partners led to new open innovations	[4,6,28,81–85]
M5	Lateral communication between the organisation and its competitors led to new open innovations	[47,76,86,87]
M6	Access to knowledge provided by research organisations	[36,77,88–91]
M7	Access to knowledge provided by education centres	[71,77,84,92,93]
M8	Subsidies (includes government financing, incentives and research subsidies)	[41,65,77, 94–96]
M9	Regulations enforced by the government to entice open user innovation	[65,76,94, 97–99]
M10	Access to programs that guide organisations in methods for adopting open user innovation	[65,94]
M11	Leadership/management strategies that guided the adoption process	[100–105]
M12	Coordination between the organisation's management and workers	[71,100,106, 107]
M13	The presence of an innovation champion primarily targeting open user innovation	[63,108–110]
M14	Pressure from world markets	[7,28,67,111]

Table 4
Correlation matrix.

	OP	DO	CA	IB	IO	EI
OP	1	0.521	0.345	0.231	0.321	0.223
DO		1	0.312	0.211	0.209	0.367
CA			1	0.134	0.344	0.123
IB				1	0.432	0.456
IO					1	0.113
EI						1

innovation. A principal component analysis (PCA) with 6 components (equal to the number of observed variables) was conducted; the exact number of components to extract later is achieved by relying on the Spree plot [114]. Using the eigenvalue-one criterion, two components are extracted, and a rotated component matrix is generated; the results are displayed in Table 5. The set of items created have high reliability as indicated by the Cronbach alpha measure that exceeds the limit of 0.7 [113].

To determine whether differences in perceptions of the *usefulness*, *challenges,* and key drivers that stimulate the sensing of open user innovation opportunities, exist between the countries analysed, a Kruskal-Wallis test, also known as a one-way ANOVA on ranks, is performed. Statistically significant differences between ordinal samples collected from Kuwait and Australia were observed as shown in Table 6.

Results in Table 6 display that there is a significantly different outcome in terms of the perception of the impact of the open user innovation on *organisation performance*, *competitive advantage*, *impact on budget,* and *ease of implementation*. For the statistically significant results, Kuwait displays a higher score in *competitive advantage*, while Australian firms display higher scores in *organisation performance*, *budget goals,* and *ease of implementation*. These results highlight that regional differences between developed and developing countries exist when it comes to the assessment of *performance* of open user innovation by SMEs, as indicated in the literature [115].

Differences in perceptions in the key drivers to open user innovation in SMEs, between Kuwait and Australia, were also examined,

Table 5
Rotated component matrix.

	Components	
	1 (alpha = 0.815)	2 (alpha = 0.864)
OP	0.832	
DO	0.812	
CA	0.801	
IB		0.876
IO		0.72
EI		0.781

Significant observations shown only. Extraction method: principal component analysis. Rotation method: Varimax with Kaiser.

Table 6
Descriptive statistics and Kruskal-Wallis test on usefulness and challenges of open user innovation (i.e. sensing opportunities).

Variable		Mean [Std]		Kruskal-Wallis test	
		Kuwait	Australia	Chi-square	df
IS	Innovation was successful	3.1 [1.51]	3.3 [1.23]	3.454	2
OP	Satisfactory organisation performance	1.7 [0.81]	3.5 [1.22]	17.231**	2
DO	Desired outcome reached	2.3 [1.4]	1.67 [0.88]	3.134	2
CA	Competitive advantage over competitors	2.8 [0.97]	1.89 [0.91]	10.876**	2
IB	Impact on Budget was positive	2.21 [1.15]	3.45 [0.98]	11.232**	2
IO	Impact on output was positive	3.65 [1.38]	3.75 [1.47]	4.567	2
EI	Ease of implementation	2.26 [1.09]	3.56 [1.25]	15.676**	2

Level of significance: *p < 0.05; **p < 0.01.

as displayed in Table 7. Several drivers of innovation vary between the developing country and developed country. For the statistically significant results, Kuwaiti SMEs display higher scores in *knowledge by education centres*, *access to* support *programs,* and *presence of innovation champion*, while Australian SMEs have higher scores in *involvement with external partners*, *communication with competitors*, *knowledge gained by research centres*, *subsidies* and *pressure from world markets*. The rest of the drivers reveal a more uniform pattern between the countries.

5. Multiple linear regression and discussion

Since the results of Tables 6 and 7 show that differences between the two countries analysed exist, it is necessary to further examine additional patterns that explain the reasoning behind the differences in *usefulness*, *challenges faced,* and *drivers of open user innovation*, in the developing and developed countries. As a result, a set of multiple regressions are deployed through stratifying the analysis based on country.

5.1. Impact of open user innovation drivers, on success of the innovation for the SME

The multiple linear regression analysis performed involved examining all 14 drivers of open user innovation as independent variables, and assessing their influences on the dependant variable, *innovation success*. The results show that most open user innovation drivers reflect on the success of the open innovation, with 7 variables and 9 variables being statistically significant for both Kuwait and Australia respectively. Overall, the results of Table 8 contain 12 statistically significant variables, indicating that the open user innovation drivers are associated with explaining the success of the innovation adopted.

For both countries, *external client involvement*, *government policy,* and *presence of innovation champion* were significant variables. The 14 drivers of innovation explained 63 % and 71 % of the variance across both countries (see R^2). In Kuwait, *client involvement*, *knowledge by education centres*, *subsidies*, *regulations*, *access to programs,* and *coordination between management and workers* are major key drives that contribute to the success of the open user innovation. This is in line with findings in the literature which indicate that involvement of the network of clients [7], along with sufficient governmental support [116], and clear leadership strategies [117] are major determinants of the performance of innovation strategies adopted by SMEs operating in developed countries. Research is not a major key driver in developing countries, where further investment is required to be made on enhancing the research capacity and capability of research institutes in developing countries [7]. This is in contrary to results displayed for Australia, which has a well-developed research sector, as embodied in its universities and research-based centres, and which act as key drivers to open user

Table 7
Descriptive Statistic and Kruskal-Wallis test on drivers of open user innovation (i.e. sensing opportunities).

Variable		Mean [Std]		Kruskal-Wallis test	
		Kuwait	Australia	Chi-square	df
M1	Client involvement	3.13 [1.76]	3.01 [1.01]	3.213	2
M2	Suppliers/subcontractors involvement	3.31 [1.22]	3.54 [0.76]	4.345	2
M3	Consultant involvement	3.89 [0.93]	3.67 [1.98]	0.960	2
M4	Involvement of external business partners led to new open innovations	1.11 [0.56]	3.12 [1.24]	10.321[a]	2
M5	Communication between organisation and competitors	1.54 [0.78]	2.97 [1.15]	12.578[a]	2
M6	Knowledge by research organisations	2.23 [1.01]	3.79 [1.67]	9.231[a]	2
M7	Knowledge by education centres	3.11 [0.34]	1.56 [0.88]	13.743[a]	2
M8	Subsidies	1.89 [0.77]	3.43 [0.41]	11.782[a]	2
M9	Regulation enforcement	4.11 [2.31]	4.24 [2.99]	5.902	2
M10	Access to programs	3.91 [1.16]	1.89 [0,75]	13.543[a]	2
M11	Leadership strategies	3.45 [1.36]	3.12 [1.28]	2.453	2
M12	Coordination between management and workers	4.56 [1.72]	4.19 [2.14]	5.421	2
M13	Presence of innovation champion	3.67 [1.14]	2.01 [1.77]	15.543[a]	2
M14	Pressure from world markets	2.01 [0.87]	3.99 [1.82]	9.356[a]	2

[a] level of significance: *p < 0.05.

Table 8
Regression - Can open user innovation drivers, predict the success of the innovation for the SME.

Variable	Description	Innovation Success – standardised β coefficients [t-stat]	
		Kuwait	Australia
M1	Client involvement	0.312 [4.55][a]	0.295 [4.02][a]
M2	Suppliers/subcontractors involvement	0.192 [0.87]	0.542 [28.91][a]
M3	Consultant involvement	0.062 [2.09]	0.354 [11.47][a]
M4	Involvement of external business partners led to new open innovations	0.121 [0.22]	0.287 [5.93][a]
M5	Communication between organisation and competitors	0.0054 [0.71]	0.121 [1.55]
M6	Knowledge by research organisations	0.146 [1.78]	0.311 [24.33][a]
M7	Knowledge by education centres	0.434 [31.55][a]	−0.055 [-2.14]
M8	Subsidies	0.521 [8.91][a]	−0.071 [-0.89]
M9	Regulation enforcement	0.453 [18.22][a]	0.207 [3.86][a]
M10	Access to programs	0.611 [29.71][a]	0.088 [1.87]
M11	Leadership strategies	−0.093 [-0.29]	0.201 [3.79][a]
M12	Coordination between management and workers	0.376 [29.03][a]	0.112 [0.56]
M13	Presence of innovation champion	0.231 [18.72][a]	0.221 [10.41][a]
M14	Pressure from world markets	−0.083 [-2.01]	0.273 [9.11][a]
R^2		0.76	0.88
Adjusted R^2		0.63	0.71

[a] level of significance: *p < 0.05.

innovation in SMEs [118]. In addition, for Australian SMEs, *communication between the firm and its suppliers*, *consultants,* and *business partners* is important in determining the *success* of the innovation. Busarovs [119] revealed a similar conclusion, with developed countries having more resources to access an extensive network of business partners and suppliers, hence enabling them to build stronger ties and maintain these ties through collaborations that entice firms to sense and seize innovation opportunities. In addition, Gassmann et al. in Ref. [71] indicated the importance and significance of policymaking in guiding the open user innovation undertaken

Table 9
Regression **-** The ability of the drivers of open user innovation to determine the usefulness of the open innovation to the SMEs.

Variable	Description	Satisfactory organisation performance (OP) – standardised β coefficients [t-stat]		Desired outcome reached (DO) – standardised β coefficients [t-stat]		Competitive advantage (CA) – standardised β coefficients [t-stat]	
		Kuwait	Australia	Kuwait	Australia	Kuwait	Australia
M1	Client involvement	0.312 [3.90][a]	0.219 [7.11][a]	0.412 [14.55][a]	0.012 [1.82]	0.112 [0.89]	0.24 [13.1][a]
M2	Suppliers/subcontractors involvement	0.012 [0.57]	−0.31 [13.17][a]	−0.06 [-0.92]	0.04 [0.61]	−0.043 [-2.18]	0.052 [0.91]
M3	Consultant involvement	−0.25 [-5.3][a]	0.018 [0.86]	0.518 [10.37][a]	0.291 [7.04][a]	0.220 [10.94][a]	0.071 [0.63]
M4	Involvement of external business partners led to new open innovations	0.04 [0.41]	0.0541 [0.75]	0.01 [0.91]	0.142 [1.52]	0.21 [1.41]	−0.034 [-2.09]
M5	Communication between organisation and competitors	0.076 [0.57]	0.031 [0.69]	−0.034 [-1.41]	−0.078 [-0.77]	0.05 [1.54]	0.143 [1.42]
M6	Knowledge by research organisations	0.012 [0.42]	0.214 [28.72][a]	0.0157 [0.63]	−0.027 [-0.81]	−0.12 [-2.11]	0.11 [0.74]
M7	Knowledge by education centres	0.010 [1.11]	−0.2 [-0.73]	−0.14 [-0.55]	−0.13 [-1.52]	0.11 [0.71]	0.06 [1.39]
M8	Subsidies	0.33 [5.81][a]	−0.09 [-1.22]	0.41 [3.91][a]	0.12 [1.01]	−0.18 [-0.51]	−0.09 [-1.93]
M9	Regulation enforcement	−0.01 [-0.47]	−0.15 [-1.46]	0.37 [19.87][a]	0.08 [0.64]	−0.02 [-0.53]	−0.14 [-0.91]
M10	Access to programs	0.05 [0.66]	0.11 [0.78]	0.29 [31.39][a]	0.18 [0.73]	−0.03 [-0.83]	−0.11 [-0.79]
M11	Leadership strategies	0.37 [24.6][a]	0.46 [8.09][a]	0.29 [4.21][a]	0.18 [3.97][a]	0.30 [12.72][a]	0.30 [3.77][a]
M12	Coordination between management and workers	0.12 [0.92]	−0.09 [-0.66]	0.05 [1.47]	0.01 [2.07]	−0.12 [-0.74]	−0.11 [-0.95]
M13	Presence of innovation champion	−0.07 [-0.73]	0.08 [1.11]	0.02 [0.85]	−0.09 [-1.23]	0.41 [19.1][a]	0.32 [31.06][a]
M14	Pressure from world markets	−0.10 [-0.55]	0.08 [0.49]	−0.09 [-1.53]	0.12 [0.65]	−0.03 [-0.54]	0.01 [1.42]
R^2		0.55	0.61	0.66	0.53	0.67	0.54
Adjusted R^2		0.49	0.53	0.59	0.57	0.61	0.75

[a] level of significance: *p < 0.05.

by SMEs in developed countries. Presence of an innovation champion was highlighted in Ref. [108] as being important for organisations, though work on the importance of innovation champions in SMEs operating in different economic developments is rarely examined.

5.2. Impact of open user innovation on the usefulness of the innovation for the SME

The ability of the drivers of open user innovation to determine the *usefulness* of the open innovation to the SMEs was examined via use of a multiple linear regression. The results are displayed in Table 9. As indicated by the adjusted R^2 parameter, the drivers of the open user innovation explain between 47 % and 61 % of the variance. Out of the five external actor drivers (M1 – M5), four variables always happen to be statistically significant, indicating the high association of the drivers with determining the *usefulness* of the open innovation. In particular, *client involvement* is an external driver which displays a strong association across all dimensions of *usefulness* examined, Table 9. For *satisfactory organisation performance, client involvement* acts as an associated external driver that is applicable to both countries. For *desired outcome reached*, the open user innovation driver *consultant involvement* is significant across the two countries examined. This is in line with the literature where it has been shown that consultants are essential in building bridges for innovation, through spanning managerial gaps [120] For *competitive advantage*, when SMEs in Kuwait are examined, the only significant open user innovation driver is *consultant involvement*, while for Australian SMEs, the only significant external driver is *client involvement. Involvement of external business partners* is not significant in ensuring the *usefulness* of the open user innovation in both countries, which does not align with previous findings in the literature [121]. *Communication between organisation and competitors* is also a non-significant predictor of the *usefulness* of the open innovation. This can be because SMEs, specifically in developing countries, would be competing for resources, and hence the level of competition between these firms can be fierce enough to prevent any sort of communication with other operating firms [122]. This is still observed in developed countries, though its impact is less obvious given the multiple supportive structures present for SMEs in such countries [123]. In particular, for firms operating in developed countries, communication with competitors occurs so long as benefit can be generated out of the collaboration [124].

When analysing the mixed in-bound and out-bound innovation drivers in Table 9 (*M6 – M14*), *research knowledge*, *education knowledge*, *subsides* and *leadership* are found to be statistically significant. For Kuwaiti SMEs, significance comes from *subsides* and *high leadership skills* to create satisfactory *organisation performance*. In Ref. [65], the importance of government support to ensure that the

Table 10
Regression – Can open user innovation drivers predict the level of ease of the implementation and lead to less challenges faced by the SMEs.

Variable	Description	Impact on Budget was positive (IB) – standardised β coefficients		Impact on output was positive (IO) – standardised β coefficients		Ease of implementation (EI) – standardised β coefficients	
		Kuwait	Australia	Kuwait	Australia	Kuwait	Australia
M1	Client involvement	−0.09 [-1.06]	0.02 [0.65]	0.209 [17.32][a]	0.411 [22.45][a]	0.021 [0.43]	0.229 [12.7][a]
M2	Suppliers/subcontractors involvement	−0.023 [-1.09]	0.11 [1.78]	0.121 [1.33]	0.342 [4.21][a]	0.267 [3.66][a]	0.288 [8.95][a]
M3	Consultant involvement	0.078 [0.71]	0.015 [0.19]	0.499 [15.6][a]	0.344 [31.04][a]	0.233 [5.11][a]	0.381 [6.73][a]
M4	Involvement of external business partners led to new open innovations	−0.120 [-0.32]	0.041 [1.12]	−0.018 [-0.75]	0.217 [23.44][a]	0.03 [1.02]	0.019 [0.44]
M5	Communication between organisation and competitors	0.105 [1.21]	0.099 [0.77]	−0.0309 [-2.03]	0.0674 [0.55]	−0.012 [-0.21]	0.321 [11.1][a]
M6	Knowledge by research organisations	0.089 [0.58]	0.263 [5.62][a]	−0.067 [-1.74]	0.342 [7.2][a]	0.0123 [0.44]	−0.034 [-1.08]
M7	Knowledge by education centres	0.076 [0.31]	0.045 [0.97]	0.321 [9.82][a]	0.212 [15.43][a]	0.20 [4.77][a]	0.198 [10.03][a]
M8	Subsidies	0.51 [17.19][a]	0.235 [6.35][a]	0.37 [5.44][a]	0.289 [19.72][a]	0.212 [16.71][a]	0.32 [6.93][a]
M9	Regulation enforcement	0.243 [14.03][a]	−0.12 [-0.41]	0.011 [0.74]	−0.098 [-0.23]	−0.017 [-0.68]	−0.006 [-0.11]
M10	Access to programs	0.42 [18.34][a]	0.321 [24.57][a]	0.60 [9.07][a]	0.18 [5.09][a]	0.232 [10.87][a]	0.543 [4.41][a]
M11	Leadership strategies	0.56 [21.3][a]	0.41 [8.92][a]	0.32 [3.37][a]	0.534 [8.11][a]	0.215 [6.33][a]	0.203 [14.18][a]
M12	Coordination between management and workers	0.222 [15.9][a]	0.201 [4.12][a]	0.45 [12.4][a]	0.18 [7.6][a]	0.632 [10.11][a]	0.643 [3.99][a]
M13	Presence of innovation champion	0.02 [0.56]	0.232 [6.51][a]	0.309 [7.33][a]	−0.121 [-0.47]	0.32 [14.66][a]	0.43 [15.3][a]
M14	Pressure from world markets	−0.32 [-8.94][a]	0.012 [0.23]	0.033 [0.79]	0.053 [0.32]	−0.052 [-1.48]	−0.199 [3.98][a]
R^2		0.78	0.61	0.82	0.77	0.80	0.64
Adjusted R^2		0.67	0.49	0.75	0.64	0.70	0.51

[a] level of significance: *p < 0.05.

adopted open user innovation translates into satisfactory performance of SMEs has been highlighted. In addition, the study in Ref. [125] discusses the importance of governmental subsidies as a key driver for ensuring that firms achieve desired outcomes of the innovation. A determinant of the usefulness of the open innovation in developed countries is the involvement of research organisations; for developing countries, this is not so much the case, since as indicated in Ref. [126] the contribution of research organisation is low in countries where university research has not yet developed. In terms of predicting the *desired outcomes* to be reached by Kuwaiti SMEs, a larger number of mixed out-bound and in-bound drivers were found to be statistically significant. In particular, all dimensions of policymaking and government intervention (*M8 – M10*), including *subsidies*, *policies,* and support *program availability* were found to be significant. This result aligns with findings in Ref. [77], where government support was listed as an important measure to ensure that SMEs are able to achieve desired outcomes when adopting an innovation. *Leadership* is again found to be important when predicting the desired output that Kuwaiti SMEs would want to achieve due to adopting the open user innovation.

In the case of Australia, the ability of *research knowledge*, and *leadership strategies* to predict satisfactory organisation performance is high. In terms of predicting the *desired outcomes* to be reached by the Australian SMEs, only *leadership* is significant. For the case of predicting the *competitive advantage* gained by SMEs, *leadership* is significant for both countries, in addition to the presence of *open user innovation champion*. Fichter [108] indicates that organisational development over other competitors is linked to how far-reaching the network of the innovation champion is.

It is worthwhile noting that during the survey, it was apparent that due to the nature of the economic environment in which SMEs operated in, Australian expectations in terms of *usefulness* of the open user innovation, were found to be higher compared to that of the Kuwaiti SMEs. Kuwait was also found to heavily rely on consultants to guide the innovation process, given that there was a limit on the other resources that SMEs can refer to, in addition to the ease of access to such services [127].

5.3. Impact of open user innovation drivers on the challenges of the innovation and ease of implementation for the SMEs

The ability of the drivers of open user innovation at predicting the *challenges* presented to the SMEs, and the *ease of implementation* of the innovation, was assessed via the multiple regression in Table 10. The adjusted R^2 reveals that the drivers in the model of Table 10 capture 49 %–75 % of the variance in *budget output* and *easements* across the two countries assessed. The analysis shows differences in the influence of the main drivers on the *challenges* faced by the SMEs. Breaking down the analysis into separate dimensions reveals some interesting findings. For the dimensions of the open user innovation drivers related to external actor involvement (*M1 – M5*), all are insignificant in determining the *impact on budget* for both countries, though when it comes to *output*, the involvement of *clients* and *consultants* was found to be significant across both countries. Specifically, for Kuwait, significance lies in the use of *clients* and *consultants* for gaining *positive output*. As discussed before, SMEs in developing countries tend to rely on outer sources heavily for guiding the strategic development of their firms [128], especially if the firms are supported by the government [129]. In Australia, significance in *client*, *supplier*, *consultant,* and *external business partners* is evident when predicting the impact on *positive output* due to the open user innovation. The reason for that is developed countries have a broader network and are thus able to engage more external drivers to ensure the success of their innovation [130,131]. For predicting the *ease of implementation*, two out of the five dimensions of external actor involvement, namely *supplier* and *consultant involvement*, are significant across both countries. In particular, for Kuwaiti SMEs, the two most significant drivers that lead to *ease of implementation* of the open user innovation include *supplier* and *consultant* involvement. For Australia, all dimensions related to external actor involvement are significant, except for *external partner involvement*. How easy the implementation of the open user innovation is to the firms applying it, depends on the external driver; the more external actors that SMEs can rely on for guiding the open user innovation, the easier it is for the firms to adopt the innovation [66]. The findings reinforce the notion that *challenges* in open user innovation adoption can mostly be attributed to the availability of resources that SMEs can utilise to guide the adoption process [71].

In terms of the use of *knowledge* by the SMEs (*M6 – M7*), and the impact they have on determining the challenges that SMEs face, all related drivers were found to be statistically significant. For Kuwaiti SMEs, *knowledge gained* through collaboration with *educational institutes* was significant in predicting the output of the open user innovation. For Australia, the emphasis was more on the use of research to enhance the budget requirements and output associated with the adoption of the open innovation. This again aligns with the discussion raised above, on differences in perceptions between developed and developing countries when it comes to research [110].

All drivers related to governmental interference (*M8 – M10*), are statistically significant. When examining the influence of the drivers across the countries, the driver *subsidies* and *access to programs* happen to lead to positive influence on *budget*, *output,* and on *ease of implementation* of the innovation. This tends to agree with the literature, wherein [65], support from the government was a major influence on *easing the implementation* of the open user innovation. *Regulation enforcement* is found not to contribute significantly to *budget* or *output improvements* in the developed country, mainly due to the free nature of the economy in developed countries where imposing rules that are restricting on businesses are less likely to occur, in contrast to developing countries [43]. A study by Ref. [98] also indicates that prescriptive regulation can impede the progress of innovation in SMEs in developed countries. Having said that however, access to support programs specifically in developing countries aids in ensuring that the open user innovation successfully contributes to the *output* and *budget* of the SME, via providing extra mentoring and training for SMEs on the best ways for seizing opportunities that have been sensed **[**117**]**.

Dimensions capturing the strategic approaches adopted by the SMEs (*M11 – M14*) are also found to be most significant. For both Kuwait and Australia, leadership strategies and coordination between management and workers, are essential for ensuring a positive impact on *budget*, *output,* and *ease of implementation* of the open innovation. Successful internal relationships and successful leadership strategies are necessary when dealing with the challenges associated with innovation adoption [77]. When it comes to the presence of

an 'innovation champion', significance is present in the case of Australia for predicting the positive impact on *budget* and the *ease of implementation*, whereas there is less influence on the *budget* and *output* for Kuwaiti SMEs. Studies such as [132] emphasise the importance of an innovation champion for determining ease of implementation and for pushing the switch from 'closed' to open innovation in businesses. Finally, the significance of *pressure from the outside world* is found to be relevant to Kuwaiti SMEs when predicting the variable that captures the *impact on budget*. For Australia, *outside pressure from world markets* is only relevant when it comes to determining the *ease of implementation* of the open user innovation.

6. Implications

This section describes the implications from the analysis conducted above. *First, in terms of innovation success*, for Australia, *external actors* play a major role. *Research* is also significant in assessing the success of the open user innovation. These findings are in line with findings from the literature [118,133]. For internal drivers, *leadership qualities*, presence of an *innovation champion,* and pressure that leads to internal reaction due to *markets' influence* are key drivers that impact the *success* of the project.

For Kuwait, the main drivers of open user innovation which predict the *success* of SMEs are ones that originate from *client involvement*, *knowledge due to collaboration with educational institutes*, *governmental* support *and policies*, along with *leadership* and *promotion of innovation champions* from within the firms. The reason for the difference between the two countries can be explained as follows: in a developed country like Australia, a system for innovation within organisations is more likely to be present than in a developing country like Kuwait. As such, the maturity of that innovation mechanism lends itself to the need for continuity and improvement via research, maintaining strong relations with external stakeholders, and ensuring that leadership are on board. For Kuwait, the innovation system is not as mature, and so would require government support, and better promotion of internal innovation champions within firms to build the open user innovation system.

Second, important drivers that underpin the usefulness of the open user innovation to developed countries differ than those in developing countries. For Kuwait, the usefulness of the open user innovation mechanism is a result of *client involvement*, *consultant involvement*, *adequate* support *from the government,* and *strong leadership strategies*. For Australian SMEs, additional drivers are necessary for the open user innovation to be useful to the organisation; for instance, there is a need to have *suppliers* engaged in the process. This is again related to the more extensive network that is available for SMEs in developed countries to utilise, in contrast to their counterparts in developing countries [7].

Third, for the Kuwaiti SMEs, the key drivers that are of importance to handle the associated challenges when seizing open user innovation opportunities, focus mostly on *engaging with consultants* to guide the adoption process and also on *government* support. For Australian SMEs, external drivers play a more significant role in addressing the challenges faced by SMEs.

Even though extensive literature is present which highlights the significance of internal drivers of open user innovation, most of the analysis conducted pertains to large firms and not to SMEs that operate in industries with low investment in R&D [134]. Thus, the results analysed in this study tend to align with large firm findings conducted in previous studies. Wang and Costello had previously mentioned that summoning internal forces within SMEs, including promoting an innovation culture, contributes to the success of seizing open user innovation opportunities [135]. SMEs can also clearly benefit from collaboration networks that are well constructed and managed [102].

The literature mostly agrees with the fact that developing countries are less likely to engage with research organisations due to the limited capacity of its research institutes, in comparison to developing countries [7]. In addition, existing studies reveal that governmental support is of high importance in promoting the open user innovation in SMEs operating in developing countries, particularly ones that are operating in low R&D industries where support for innovation from within organisations is rarely available [116].

SMEs operating in developed countries have more access to resources and hence have a broader network of external actors that they can summon to help maximise the usefulness associated when seizing opportunities for open user innovation [23]. SMEs in developing countries, on the other hand, tend to rely more on government support, with some involvement of clients, educational institutes, and consultants if accessible [117].

7. Conclusion

This study investigated the main drivers that influence sensing opportunities of open user innovation adopted by SMEs operating in low R&D industries and in different economic development settings. An attempt was also made to understand the *success*, *usefulness,* and *challenges* of the innovation as perceived by the SMEs. Data from a survey conducted in Kuwait and Australia was analysed statistically. Emphasis was placed on understanding the differences in success, usefulness, and challenges that are faced by firms in developed and developing countries.

Perceptions of success of the open user innovation adopted by the SMEs in both countries were first identified. Drivers that SMEs perceived as significant when it came to sensing open user innovation opportunities was also identified. A difference in the perception of *usefulness*, *challenges,* and key drivers between SMEs operating in Australia and Kuwait was detected; this was then further examined via a stratified analysis based on country of operation of SMEs.

The results of the multi-regression analysis conducted indicated that significant drivers of open user innovation for SMEs operating in Kuwait, in terms of predicting the *success* of the innovation, were attributed to the *external influence of clients, consultants, and government* support that the SMEs received. On the other hand, for Australian SMEs, a more *extensive network of external actors* eventuated in additional external drivers contributing to the success of the open user innovation adopted. For predicting the *usefulness*

of the open user innovation to the SME across the *performance*, *output,* and *competitive advantage* dimensions assessed, *government* support was the major significant driving factor for Kuwaiti SMEs, as opposed to external actor involvement and presence of *innovation champion* in Australian SMEs. SMEs in both countries regarded *internal leadership* strategies as highly significant in predicting the *usefulness* of the innovation to the SME. A common difference that exists between SMEs operating in the developing *vs* developed country, in terms of the dimensions of *success* and *usefulness* of the innovation, was in the involvement of research institutes as key drivers to the open user innovation. Given the greater research capacity present in developed countries, in contrast to developing countries, the significance of research institutes as key drivers of open user innovation was more prominent in Australia than in Kuwait. In terms of *challenges* perceived by SMEs in both countries, there was a consensus on the importance of *government* support provided to SMEs, *coordination* between management and workers in the firms, and presence of *innovation champion* when it came to the handling of these *challenges* presented by open user innovation adoption. In addition, Australian SMEs had attributed their *collaboration with research institutes* as significantly contributing to aiding the SME in facing the *challenges* associated with open user innovation.

A summary of some of the managerial insights and implications gleaned is as follows: External actors play a major role in the success of the implementation of open user innovation in SMEs. SMEs could benefit from external expertise to guide the adoption process of open user innovation. Client involvement, and strong leadership strategies are key aspects in the usefulness of the open user innovation in SMEs operating in developing countries. For developed countries where SMEs are more mature in their open user innovation adoption, the usefulness of the implementation can be enhanced via *suppliers'* engaged in the process. At a country level, policy should target more governmental support for SMEs in developing countries to enact open user innovation.

Certain aspects can be further investigated to help cover limitations currently present in this study. To better understand the impact of investments in R&D, a stratified analysis of SMEs operating in different low and high R&D industries can be carried out. Furthermore, a stratified analysis that considers the size of the SME and its years of operation can also be analysed. A better understanding of the underlying project management techniques that can be adopted to further the success of open user innovation drivers can also be examined. This should give a broader view of specific dimensions of *success*, *usefulness,* and *challenges* that SMEs operating in different countries might want to consider when deciding on drivers to adopt to enhance the adoption of open user innovation. A more rigorous qualitative analysis would be needed to supplement the quantitative assessment conducted in this study.

Ethics declaration

All participants provided informed consent to participate in the study.

CRediT authorship contribution statement

Mana Alyami: Writing – original draft, Project administration, Methodology, Funding acquisition, Data curation. **Muhammad Faisal Javed:** Writing – review & editing, Validation, Supervision, Resources. **Ahmed WA. Hammad:** Writing – original draft, Supervision, Project administration, Conceptualization. **Assed Haddad:** Visualization, Validation, Methodology, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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