MERGING ACADEMIC RESEARCH AND CONSTRUCTION INDUSTRY DEVELOPMENT REQUIREMENTS: A CONCEPTUAL FRAMEWORK

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ABSTRACT

Academic research in built environment consists of cognitive and affective, as well as behavioural components. There is a broad consensus in the literature that successful communication between researchers and research users is crucial for the effective utilisation of research in decision-making in policy and practice. It is argued that academic researchers and the construction industry practitioners do not collaborate closely in construction sector. The need for sharing knowledge between research institutions and industry has become increasingly evident in recent years. Therefore this study aims to uncover the strategies in merging academic research with industry development requirements where this paper presents the literature review findings in a form of a conceptual framework. The importance of transfer, barriers for transfer and way forward for both academia and construction industry is presented within the framework with highlighted inter-relationships. The framework will be developed into a model after analysing findings of a field study which is to be conducted in the future with the use of Delphi technique. In that, the model will be validated with an expert survey where the panel includes both the academics and industry practitioners. Results of the study therefore are expected to serve both academia and industry in merging their interests towards the development of the sector.

Keywords: *Academic Research; Barriers: Construction Industry; Importance; Way Forward.*

1. INTRODUCTION

Construction industry needs to move beyond the traditional practices to adopt new practices arising from research and development (R&D) activities. Kulatunga *et al.* (2005) state R&D acts as a valuable input for the construction organisations. However, there is lack of evidence that construction industry adopts new findings of R&D activities into their practice (Pheng and Hua, 2002). In fact, partnerships amongst governments, economic sector and research universities are growing considerably, to make sure that new knowledge becomes linked to development goals (Kassel, 2009). However, relationships between academia and industry are increasingly intimate and commercial. While opportunities are created for each partner, there are also important conflict of interest issues (William *et al*., 2004). Academics are challenged when trying to implicate research into the practice, especially when they are demanded to involve in both pure and applied research while industry is challenged in moving away from the traditions and going ahead with current development trends. This urges the need of merging academic research and practice as the way forward. In merging research and practice, there would be subsequent requirements to be addressed with the preliminary requirement of developing relationships between researchers, funders and the practitioners. A collaboration where the interests and values of each partner are articulated in advance and conflict of interest issues are resolved before legal and business arrangements are established in a contract would be essential. Accordingly this study aims to explain how to merge academic research with industry development requirements to have a better responsive construction industry practice in Sri Lanka. The PhD research which this paper is based on has now reached its field survey stage where this paper presents the conceptual framework developed based on the findings of the comprehensive literature survey carried out.

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2. IMPORTANCE OF TRANSFERRING ACADEMIC RESEARCH OUTCOME TO THE INDUSTRY

Communicating research outcomes lies at the heart of academic endeavour, because it contributes to improved knowledge and understanding and guides further research. Moreover, bigger the project and the higher the level of the degree, the more likely it is that research outcomes would be worth communicating beyond the basic requirements to the broader research community. This may be beneficial to both the advancement of research in the particular field of interest and to the academic careers of the research graduates (Hays, 2007). Hence, the factors identified through the literature are presented in Table 1.

Table 1: Importance of Transferring Research Outcome – Academia's Perspective

Importance	References
Towards Academic Affiliation	
1. Research being a major responsibility, academics should carry out research that serves educational needs	Boyer Commission (1998)
2. To improve employment skills of the next generation of professionals	Fielden (2008); OECD (2010)
3. To attract new research students	Cullen, Joyce, Hassal, and Broadbent (2003)
4. To become a research-led university	Boyer Commission (1998)
5. Linking Research to improve Teaching	Boyer Commission (1998)
6. As communicating research outcomes lies at the heart of academic endeavour	Sparrow, Tarkowsky, Lancaster and Mooney (2009)
7. To guide further research	Sparrow, Tarkowsky, Lancaster and Mooney (2009)
8. To support individual professional development	Virolainen (2007)
9. For advancement of the academic careers of the research graduates	Hays (2007)
Beyond Academic Affiliation	
1. Research being a major responsibility academics should carry out research that serves the development of the region and its economy	Boyer Commission (1998); Virolainen (2007)
2. Add new knowledge in order to serve the wider society	Houston (2008)
3. To bringing in innovation to the particular industry	OECD (2010)
4. shaping the culture, paradigms and practices	Fielden (2008)
5. Accommodate and respond to key external parties in expectations	Houston (2008)
6. Dissemination of knowledge to the existing industry environment also becomes a duty to the academics	Boyer Commission (1998)
7. Source of new ideas and collaborating to maximising use of ideas	European Commission (2007)
8. For the advancement of research in a particular field of interest	Hays (2007)

Dissemination is only achievable and successful if, from the outset, there is a shared vision and common understanding of what one wants to disseminate together with a way of describing that to those who stand to benefit from it (Ordoñez and Serrat, 2009). Hence, it is essential to think about what benefits the knowledge product will offer to a particular industry.

Table 2: Importance of Transferring Research Outcome – Industry Perspective

Importance	References
At National Level	
1. Address the economic, environmental and resource constraints	Kulatunga, Amaratunga and Haigh (2005)
At Industry Level`	
1. To survive and proliferate through innovation	Hughes and O'Rourke (2009)
2. Develop new products, materials, advanced construction processes	Kulatunga *et al*. (2005)
3. Deliver better value for money	Fairclough (2002)
4. Increase construction industry productivity	Maqsood and Walker (2007)
5. Increased design and performance quality	Le and Bronn (2007)
6. Finding solutions to the challenges faced by the construction industry	Barrett (2007)
7. Making it highly valued by its customers	Barrett (2007)

Importance		References
At Organisational/Individual Level		
1.	In order to sustain long-term competitive advantage of organisations	Sparrow, Tarkowsky, Lancaster and Mooney (2009)
2.	Guide on effective management of human resources	Jones and Robinson (1997)
3.	'Knowledge economy' is an emergent reality for many organisations	Laszlo and Laszlo (2002)
4.	For continuous performance improvement	Hughes and O'Rourke (2009); Fairclough (2002)
5.	To become more profitable	Fairclough (2002)
6.	To be competitive through technological advances	Kulatunga, Amaratunga and Haigh (2009)
7.	Cost efficiency improvements	Le and Bronn (2007)
8.	Enhances the effectiveness of construction organisations	Kulatunga, Amaratunga and Haigh (2005)
9.	Managerial developments	Kulatunga, Amaratunga and Haigh (2005)
10.	Lead project team deliver high quality projects at lower costs in shorter times	Oyedele (2010)

3. BARRIERS FOR TRANSFERRING ACADEMIC RESEARCH OUTCOME TO THE INDUSTRY

According to Ordonez and Serrat (2009), where efforts to disseminate knowledge products are earnest, low impact is mainly attributable to poor planning and the absence of a dissemination strategy. Traditionally, it is found that the academic researchers and the construction industry practitioners do not collaborate closely in most construction research projects with creating lots of barriers for proper dissemination. The barriers for academics in transferring research which were identified through the literature review and are presented in the below Table 3 under the categories, internal barriers and external barriers.

Table 3: Reasons for Poor Research Interactions – Academia's Perspective

Barriers		References
Internal Barriers		
1.	Demand to involve in both pure and applied research	William *et al.* (2004); Kassel (2009)
2.	Maintaining traditional role in public science while partnering with a commercial entity with a tradition of proprietary science	William *et al.* (2004)
3.	Increasing pressure from stakeholder groups in quality	Payne (1996)
4.	"Think global, act local" challenge	Kassel (2009)
5.	Poor planning and the absence of a proper dissemination strategy	Ordoñez andSerrat (2009)
6.	Low success in getting a share of research funds from abroad	Meek *et al.* (2009)
7.	Poor use of communication mechanisms	Pheng and Hua (2002)
External Barriers		
1.	Diminishing financial support from public sources of finance together with the high requirement of funds for developing activities	OECD (2010); Abbott, Aouad and Madubuko (2008)
2.	Passive and low dissemination	RD Direct (2009)
3.	Allocation of resources as R&D requires different type of resources	Senaratne *et al.* (2005);
4.	Changes in funding mechanisms	Senaratne *et al.* (2005)
5.	Fashionable management concept ignored by practitioners	Hambrick (1994)
6.	Changes brought by research will be seen over a long period of time rather than immediately at some points	Marsh (2010)
7.	Commercialisation threats to "open science" and academic freedom	Meek *et al.* (2009)
8.	Increased global competition in higher education and research	Meek *et al.* (2009)
9.	Indicators of "cutting-edge" research underscore gaps	Meek *et al.* (2009)
10.	Low- and middle- income countries have limited capacity for reviewing the quality of programmes	Meek *et al.* (2009)

Barriers	References
11. Resource pools for research in many low- and middle-income countries, even if financially sufficient, might be too small	Meek *et al*. (2009)
12. Goals of transnational education programmes and the paradigms of research so driven by the perspectives of economically advanced countries	Meek *et al.* (2009)
13. Practitioners often do not entertain innovative research ideas	Azhar (2007)

However significant evidence could be given from the industry to support the argument that the industry is slow in innovation adaption. At the same time, it is argued that the construction industry has considerable barriers to accepting innovation in general. Further these barriers can be again categorised into three as the barriers created at the national level, industry level and organisational or individual level. Therefore it suggests that the research outcome transfer is not totally the responsibility of academics but industry collaboration is essential backed with the national level action plans. Further the efforts will be rewarding for the national economy as construction industry being a major contributor to the national income in Sri Lanka.

Table 4: Reasons for Poor Research Interactions - Industry Perspective

Reasons	References
At National Level	
1. Moving away from the traditions and going ahead with development trends	William *et al.* (2004)
2. No necessary investments and benefit access to high-quality knowledge	Meek *et al*. (2009)
3. Lack of appropriate leadership	Jones and Saad (2003 cited Maqsood and Walker, 2007)
4. Timidity in leading the adaptation of new technologies	Jones and Saad (2003 cited Maqsood and Walker, 2007)
5. Ignorance about good quality academic research	Pheng and Hua (2002)
6. Not very influential and useful, especially when less-funded and consulted	BERR (2008)
At Industry Level	
1. Ignorance of the knowledge worker, their skills and skills agenda	O'Donnell (2008)
2. Pace of developments are integrated and implemented in the sector is slow	Hughes and O'Rourke (2009)
3. Low responsiveness to the changes	Bettelle (2010); Koebel, Papadakis, Hudson and Cavell (2004); Fiarclough, (2002)
4. Lack of investment on R&D by the industry	Bettelle (2010)
5. Culture of conservatism	Jones and Saad (2003 cited Maqsood and Walker, 2007)
6. Impractical to use in real- life construction projects	Azhar (2007)
7. Industry mind-set that academic research is not directly usable and valid	Pheng and Hua (2002)
8. Lacking direction and resources to test and implement research outcomes	Pheng and Hua (2002)
At Organisational/Individual Level	
1. Less adoption of new findings of R&D activities into practice	Pheng and Hua (2002)
2. Lack of skilled people in construction organisations	Kulatunga et al. (2005)
3. R&D expenditure as a proportion of turnover	Fairclough (2002)
4. Unawareness	Hughes and O'Rourke (2009)
5. Less knowledge	Hughes and O'Rourke (2009)
6. Competences among construction companies	Hughes and O'Rourke (2009)
7. Less incentives	Hughes and O'Rourke (2009)
8. Outdated skills of professionals	O'Donnell (2008)
9. Increasing costs to train employees in high technology environment	Wall and Ahmed (2008)
10. Academic research focused on subjects not crucial for industry	Azhar (2007)
11. Academic research results are sometimes inapplicable	Azhar (2007)
12. Poor learning organisational orientation	Jones and Saad (2003 cited Maqsood and Walker, 2007)
13. Lack of investment in people	Jones and Saad (2003 cited Maqsood and Walker, 2007)
14. More mature workers already active in the workforce	Hall and Sandelands (2009)

15.	Published in research journals that are difficult for practitioners to access	NCTM (2010)
16.	Reported in an academic style that makes them difficult to interpret	NCTM (2010)

4. WAY FORWARD IN MERGING ACADEMIC RESEARCH AND INDUSTRY DEVELOPMENT REQUIREMENTS

Based on the factors presented above, it could be argued that academic research and industry development should be merged so as to be more useful to practitioners and to policymakers, allowing the latter to make better-informed, less speculative decisions that will improve practice more reliably. In such a process of merging academic research and industry practice, several studies have identified many important elements which should be addressed. However, as Sabelli and Dede (2000) argue, the impetus for these changes must initially come from the research community. Therefore the research has identified some possible actions to be taken by the academia for proper research outcome dissemination. Further the actions were identified under three categories as to be considered at the initiation of the research, during the research process and finally at the dissemination stage.

Table 5: Way Forward for Academia

Way Forward		References
At the Initiation		
1.	Partnerships amongst governments, the economic sector and research universities to make new knowledge linked to development goals	Kassel (2009); Meek, Teichler and Keanrney (2009)
2.	Research to be more biased towards applied sciences over pure sciences	Virolainen (2007)
3.	Need to play a more active role in relationship with industry	European Commission (2007)
4.	Not only to overcome global challenges, but for individual industries	Marsh, (2010)
5.	Establishing networks of expertise on research	Abbott, Aouad and Madubuko (2008)
6.	Dissemination plan into initial academic research proposals	Ordoñez and Serrat (2009)
7.	Dissemination exercises with milestones identified and set early	Ordoñez and Serrat (2009)
8.	Research with structure and organisation, linked to the practical needs	EN (2011)
9.	Objectives; into supported activities, to respond to emerging policy needs	EN (2011)
During the Research Process		
1.	Quality researching	OECD (2010)
2.	Need to play a more active role in relationship with industry	European Commission (2007)
3.	Specialist staff to manage knowledge resources with business potential	European Commission (2007)
4.	Re-shape research culture with better compatibility with the industry	Virolainen (2007)
5.	Establishing networks of expertise on research	Abbott, Aouad andMadubuko (2008)
6.	Research with high dissemination capacity	Alker (2008)
7.	Balance teach-ability, complexity and specificity of research	Bogers (2011)
8.	Improve trust upon research findings	Bogers (2011)
9.	Include summary documents	Ordoñez and Serrat (2009)
10.	Letters of thanks to study participants	Ordoñez and Serrat (2009)
11.	Newsletters to study participants	Ordoñez and Serrat (2009)
12.	Quality control to ensure accuracy, relevant, representative, and timely	Ordoñez and Serrat (2009)
13.	Value creation process	Le and Bronn (2007)
14.	structure and organisation better linked to practical needs of the industry	EN (2011)
15.	Reduce complexities of research funding	EN (2011)
Outcome Dissemination		
1.	Specialist staff to manage knowledge resources with business potential	European Commission (2007)
2.	Higher the level of the degree, research outcomes worth communicating	Hays (2007)
3.	Establishing networks of expertise on research	Abbott, Aouad and Madubuko (2008)
4.	Availability of product to as large a proportion of the target audience	Ordoñez and Serrat (2009)
5.	Interactive dissemination process, allowing feedback from audiences	Alker (2008)

Way Forward		References
6.	Active dissemination by tailoring research findings to a target audience	RD Direct (2009)
7.	Packaging dissemination techniques	Meek (2009)
8.	Shared vision and common understanding	Ordoñez and Serrat (2009)
9.	Identify audience, map with awareness, understanding, action to be taken	Ordoñez and Serrat (2009)
10.	Presented as a benefit and solution to users	Ordoñez and Serrat (2009)
11.	Communicating to wider community beyond immediate research reports	Hays (2007)
12.	Effective communication channels	Alker (2008)

This situation further dictates the need to enhance the academic researcher-practitioner collaboration for the construction industry (Azhar, 2007). Hence, this section further explores how such collaboration could be built in construction industry. According to the theoretical background findings there were some prominent actions which could be undertaken by the industry in order to create a better research integration into the practice. The actions were to be initiated as at the national level, industrial level or at the organisational or individual level. Further this aligns with the earlier findings of this research where it has identified barriers created at the national level and industrial level which requires higher level of action implementation.

Table 6: Way Forward for Industry

Way Forward		References
At National Level		
1.	Develop open innovation approaches to R&D	European Commission, (2007)
2.	Use public research as a strategic resource	European Commission, (2007)
3.	Capacity building to access and use research	Alker, (2008)
4.	Industry investments of self-interest or to respond to the demands	Koebel *et al*, (2004)
5.	Development of procurement	Hall and Sandelands (2009)
At Industry Level		
1.	Move beyond the traditional practices to adopt new practices	Kulatunga et al. (2005)
2.	Research use included in job-descriptions	Alker (2008)
3.	Skills agenda - the ability to attract, retain and develop skilled people is increasingly a required core competence	O'Donnell (2008); Hall and Sandelands (2009)
4.	Updating knowledge of the workers comparatively with the new knowledge generation	O'Donnell (2008); Wall and Ahmed (2008); Amaratunga, Pathirage, Keraminiyage and Thayaparan (2010)
5.	Development of strategic and professional leadership	Hall and Sandelands (2009)
At Organisational/Individual Level		
1.	Combining in-house and external resources	European Commission, (2007)
2.	Aim to maximize economic value from their intellectual property, even when it is not directly linked to their core business	European Commission, (2007)
3.	Use as a criterion for staff appraisal	Alker, (2008)
4.	Rewarding research-informed decision-making	Alker, (2008)

In merging research and industry development, it is crucial to have a strong link between these three related segments, researchers, practitioners and research funders. As Alker (2008) describes, communication between researchers, research funders and research users can happen in many different ways due to the number of different research users, the variety of research producers and the number of policy levels. Hence, there is a need to identify the ways and methods to link the addressed three sectors with effective communication channels where it leads for some collaborative actions. Therefore some actions that need can be implemented by academia and industry together were identified through the literature review are presented in the below Table 7.

Table 7: Way Forward for the Parties Together

Way Forward		References
1.	Collaboration where interests and values of each partner were articulated	Azhar (2007)
2.	Undergraduate research more into actual issues in the industry	Blackman and Kennedy (2009)
3.	Communication between researchers, research funders and research users	Alker (2008)
4.	Review how research be connected to real-world activity and policy setting	Marsh (2010)
5.	Research to be judged also by industry impact and tangible benefit	Marsh (2010)
6.	Joint publications between university, industry and government	Meek (2009)
7.	Knowledge broker	Alker, (2008)
8.	Embedding researchers within companies as part of existing research activity	Aouad, Ozorhon and Abbott (2010)
9.	Strategic partnerships	Meek (2009)
10.	Collaborations and partnerships among governments, economic sector and universities to make new knowledge linked to development goals	Meek (2009); Kassel (2009)
11.	Enhance researcher-practitioner collaboration to research on problems which are vital for construction industry and to find out adoptable solutions	Meek (2009); Azhar (2007)
12.	Broadening participation in programmes	EN (2011)
13.	Increasing the competitiveness and societal impact	EN (2011)
14.	Understanding the process and of building systems for innovation	Meek (2009)

Therefore a collaboration where the interests and values of each partner were articulated in advance and conflict of interest issues were resolved before legal and business arrangements were established in a contract is the correct path to head off.

5. CONCEPTUAL FRAMEWORK DEVELOPMENT

Conceptual framework was developed in order to present the literature survey findings in an easy to capture format as presented briefly in the Figure 01 given below. There have been identified two focused establishments as the 'construction industry' and the 'academia'. 'Academia' is limited only to the scope of university academics who are researching into the area of 'construction industry'. Major action focused under this research is the 'knowledge transfer' which is between the academia and the construction industry. Further three kinds of related links between the entities and the research knowledge transfer was uncovered within the clearance of theoretical background namely, the importance, barriers and way forward. 'Importance' was identified in two separate directions as the importance of research knowledge transfer from academia's perspective and industry's perspective. There were 19 factors to suggest the importance of transferring research knowledge from academia's perspective, 26 factors to suggest that it is important from industry's perspective.

Further, 'Barriers' were again identified in three way fold as reasons coming from academia reducing the knowledge transfer, reasons coming from industry and also reasons created by social influence. 25 reasons were identified from the literature as coming from the academia together with 50 reasons coming from industry perspective as for poor knowledge transfer.

Most importantly in achieving the research aim, the possible ways forward for each sector were identified. Further, there were some steps need to be taken by the two entities together. Actions to be taken by the disciplines were categorised under three stages as at the initiation during the research and at the stage of research knowledge dissemination. There were 16 possible actions were identified to be followed by the academics at the initiation of the research, 16 actions during the research process and thirteen actions to be followed at the outcome dissemination. Further, for the industry practitioners, there were 23 possible actions were identified. The actions were again divided into three groups as to be taken forward by national level, industry level and organisational/individual level. Further, some more 15 actions which can be implemented together by the industry and academia were identified to be tested in the industry through a properly designed field test which will be the next step of the original research which this paper is based on.

However, the paper presents only the latest factors due to the paper length restrictions.

6. SUMMARY AND WAY FORWARD

The construction industry being one of the important industries in the economy, it's stakeholders need to adapt complex and changing conditions continuously to sustain and proliferate through innovation. R&D acts as a valuable input for the construction organisations innovation in many ways. Therefore, it is important to move beyond the traditional practices in the construction industry to adopt research and development activities. This paper presents a framework developed based on the literature survey to promote better research outcome dissemination.

The main research study which this paper is based on aims to explain how to merge academic research and industry development requirements to have a better responsive construction industry practice in Sri Lanka. The objectives were set as below in order to achieve the research aim.

- Identify why research outcome does not disseminated to the industry from the point of the view of academics
- Explore the industry need for R&D
- Identify the reasons for industry's non–adoption of exiting academic research to fulfil the need from the point of the view of the practitioners
- Develop a mechanism to merge academic research and industry development requirements based on the results of first two objectives and by referring to models developed in other countries.
- Test the applicability of the developed mechanism in the actual setting.
- Develop guidelines to merge academic research with industry development requirements based on the testing experience.

A "mixed research method" conducted in Delphi rounds will be followed in achieving the research aim. As a research method, mixed method focuses on collecting, analysing, and mixing both quantitative and qualitative data in a single study or a series of studies. As Cresswell, (2006) explains, its central premise is that the use of quantitative and qualitative approaches in combination provides a better understanding of research problems than one approach alone. Surveys will form a part of the mixed method which will be followed here, which is discussed by Fowler (2008) as a method with the purpose to produce statistics, that is, quantitative or numerical descriptions about some aspects of the study population. According to Yin (1994), case study is an in-depth inquiry in its real setting that offers an explanation, exploration or description based on the case study actors, when the boundaries between the phenomenon and the context cannot be separated. Data which are to be collected based on this mixed method will be analysed scientifically. Conclusions will be to be made thereafter with the use of findings and a guideline will be developed to direct researchers and practitioners to create a better responsive construction industry for Sri Lanka.

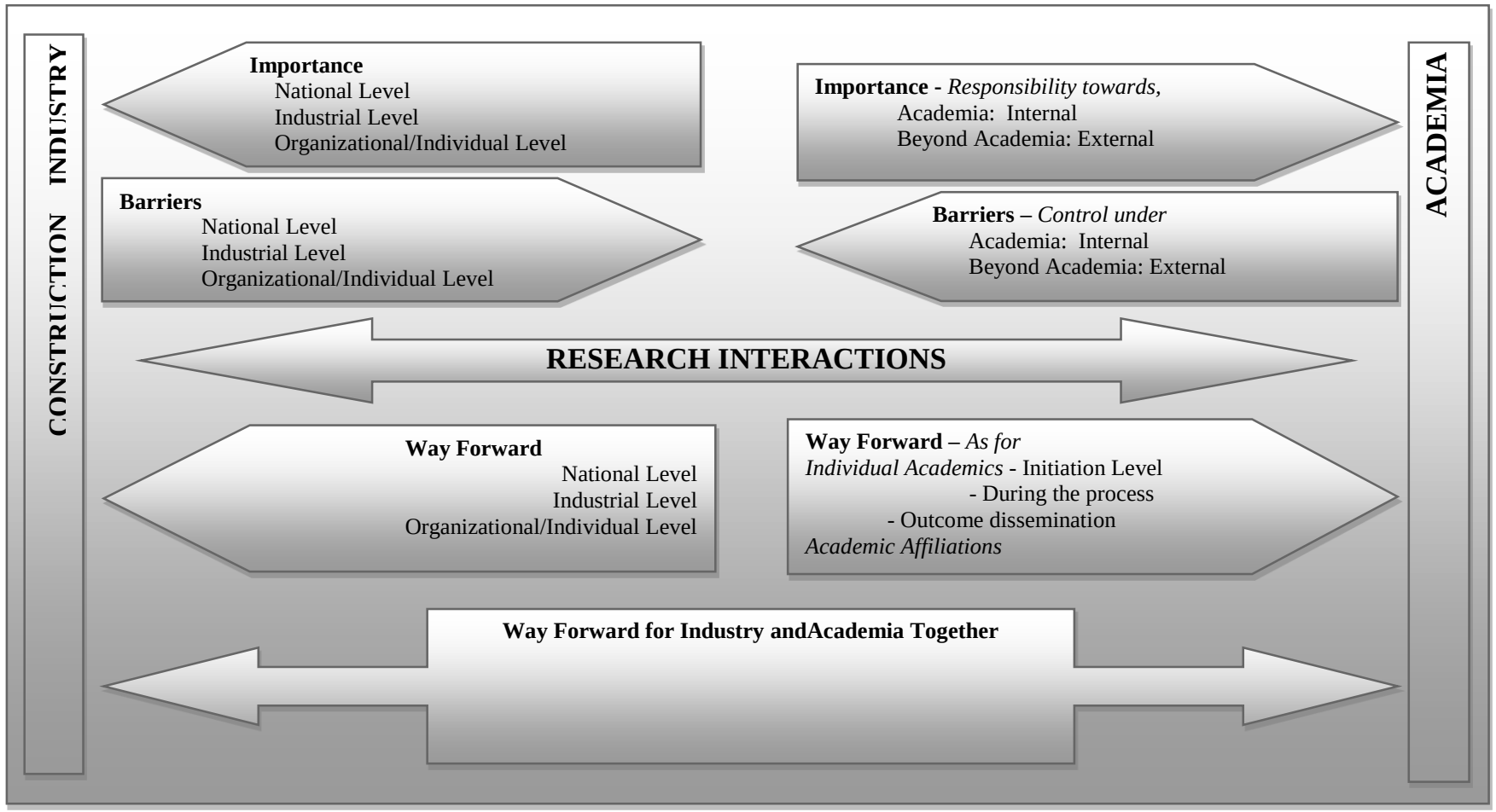

Figure 1: Conceptual Framework

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