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**Apprenticeship for Craftspeople in the Construction Industry: A state-of-the-art Review**

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**Apprenticeship for Craftspeople in the Construction Industry: A State-of-the-Art Review**

**ABSTRACT**

**Purpose**

Apprenticeship programmes are designed to provide young trainees with essential broad-based skills. Through apprenticeships, different sectors that are underpopulated can fill up their skills gaps. Apprenticeships are particularly useful to the construction sector which has a high ageing workforce and associated lower labour productivity. However, the completion rates of apprenticeship training programmes in the construction sector remain low in several countries across the globe. Thus the study purposes to review the published research on apprenticeship training that is specifically focused on the construction sector, so as to determine the current status quo and suggest a direction for future research.

**Design/methodology/approach**

A systematic review approach was adopted. Based on a comprehensive search using SCOPUS databases, 33 relevant journal articles were identified and analysed.

**Findings**

It was found that monitoring and control is the most mentioned factor responsible for improvements in the completion rates of apprenticeship training. In contrast, the length of time required for going through the full training is the most common factor responsible for low completion rates. Three research gaps were identified, among which the dearth of studies that have focused on apprentices is training in developing countries.

### **Research limitations/implications**

The gaps identified in the current knowledge on apprenticeship training would serve as a justification for future investigations. However, the scope of the review is limited to papers published in academic journals and citable through SCOPUS.

### **Practical implications**

The outcomes of the study provide researchers and other relevant stakeholders with a concise report on the findings of previous studies. It also provides insight into strategies for improving the completion rates of apprenticeship training in the construction sector.

### **Originality/value**

A systematic evaluation of the extant literature draws on theoretical evidence and highlights the factors that are more likely to influence the outcomes of apprentice training for craftspeople in the construction sector.

**Keywords:** Apprentice training programme, craftspeople, construction industry, skill shortage, systematic review

## **INTRODUCTION**

The poor performance of projects in the construction sector is a recurring problem in several countries; for example, in the United Kingdom (UK) and South Africa (Jennings, 2012; Molloy and Chetty, 2015). Reduced productivity and financing have been identified as among the reasons responsible for the poor performance of construction projects (Thomas et al., 2002; Lu et

al., 2017). Studies have shown that reduced productivity can be linked to ageing and shortage in the construction workforce (Thomas and Horman, 2006; Hasan et al., 2018). It has also been reported that the reduction in contractors' profits stems from the scarcity of construction workers (Construction Industry Development Board, 2017). Thus, shortages in the workforce hurt projects and businesses in the construction sector. Strategies targeted at attracting young workers to the construction sector are essential for sustainable development.

Apprenticeship programmes are designed to attract young people to, for example, the construction sector and provide trainees with essential broad-based skills for practising a trade. It is expected that the trainee would be competent to practise a trade at the end of the training programme. Apprenticeship programmes provide a stream of competent young people to replace the ageing construction workforce. The 'Enhanced Construction Manpower Training Scheme' in Hong Kong (Ho, 2016), and the 'Modern Apprentice' and 'Young People Training Programme' in the UK (Anderson, 2014; Hogarth and Gambin, 2014) are examples of apprenticeship training programmes.

The metric used for quantifying the success of apprenticeship training programmes varies from country to country. For example, certification (for passing a trade test), is the metric used for measuring success in the UK (Gordon et al., 2009; Clarke and Herrmann, 2007). Another yardstick is that an apprentice needs to participate in a predetermined number of hours of training to be able to complete the training process successfully (Bilginsoy, 2003).

The successful completion of apprenticeship training remains a problem in several countries across the globe. The non-completion rate for apprenticeship programmes hovers at about 30% in the UK, (O'Connor, 2016) and 45% in Australia (Bednarz, 2014). Successful completion of an

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3 apprenticeship is essential for running cost-efficient training programmes. A considerable  
4 amount of literature has been published on successful completion (Simon and Clarke, 2016;  
5 Tichon and Diver, 2010) and non-successful completion (Arkani et al., 2003; Morgan et al.,  
6 2008) of apprentice training for craftspeople in the construction sector. However, there has been  
7 no comprehensive review of the factors responsible for the success/failure of apprenticeship  
8 training programmes. A systematic review of relevant studies has thus been conducted to address  
9 this gap in knowledge.

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11 The key questions answered in the review are: (I) What is the current trend in construction  
12 craftspeople apprentice training studies? (II) What is the current distribution of construction  
13 craftspeople apprenticeship training programme studies globally? (III) Where are construction  
14 craftspeople apprentice studies commonly published? (IV) What are the methods used in  
15 investigating craftspeople apprentice training programmes? (V) What are the factors responsible  
16 for improvements in the completion rates of apprenticeship training of craftspeople? (VI) What  
17 are the factors responsible for the low completion rates of apprenticeship training of  
18 craftspeople?

19  
20 This systematic review of the literature provides an insight into what is known and highlights the  
21 gaps in the current knowledge about the subject matter, thereby providing guidance on areas for  
22 future research (Ke et al., 2009). The outcome of this review is intended not only to point  
23 researchers towards areas for extending the knowledge in this area but also to provide  
24 information to relevant stakeholders on how to improve the outcomes of apprenticeship training  
25 programmes for craftspeople in the construction sector.

*Global overview of apprenticeship programmes for craftspeople in the construction sector*

The models used for the training of craftspeople apprentices in the construction sector tends to vary from one country to another. A concise description of the models used in various locations is discussed in this section.

In Canada, the apprentice training programme is made up of two main components: classroom teaching and on-the-job training. The supervisor of an apprentice is expected to fill in a logbook which describes the tasks done by each trainee (Fayek et al. 2003). Fayek et al. (2003) point out that adequate supervision is vital towards ensuring that an apprentice can carry out various tasks safely without additional cost. In British Columbia, the possession of certification is not mandatory for practising some construction trades (Coe, 2013). However, the possession of Red Seal certification is vital for labour mobility within the provinces of Canada (Gunderson and Krashinsky, 2016). This certification indicates that an apprentice has passed the standardised interprovincial exam.

In the US, apprenticeship training for craftspeople is usually funded by either government or the private sector and encompasses classroom instruction and on-the-job work experience. It takes about 3 to 4 years to complete crafts training in the US (Glover and Bilginsoy, 2005), and Wood (2012) discloses that a 'Certificate of Completion' is issued to trainees at the end of a training program.

National Vocational Qualifications (NVQs) are in operation within the UK. The NVQ framework provides trainees with various options for acquiring competence in different trades. In the UK, it takes an average of 2 to 3 years to complete apprenticeship training for craftspeople

(Hogarth and Gambin 2014). Arkani et al. (2003) describe the various stages of training within the NVQ framework. In the first year, students can try their hand at numerous trades. Trainees are expected to complete the Level 2 NVQ within 2 years of training and Level 3 (fully skilled) in 3 years (Arkani et al. 2003). At the end of the training, trainees receive their certification after passing an exam.

In Scotland, unlike in England, the completion of an NVQ at Level 3 is the minimum qualification for practising a trade. In Scotland too, there has been a shift away from exams to competency-based assessment (Gordon et al., 2009). This approach is reliable and robust for evaluating the level of competence developed over time.

Taken together, various models are used around the world for the training of apprentice craftspeople in the construction sector. Yet despite the variance in the training and certification requirements across countries, the models are seen to be effective. However, low completion rates were observed in craftspeople apprenticeship programmes across the globe. Based on this observation, this current study is focused on reviewing previous research on the factors responsible for the success/failure of apprenticeship training programmes.

## RESEARCH METHOD

Several research methods have been used e.g. in previous studies to solve different problems in the field of construction management. The nature of the problem is one of the main factors affecting the suitability of a particular approach (Wing et al., 1998). This study therefore aims to reveal the gaps and trends in current knowledge relating to apprenticeship training programmes for craftspeople in the construction sector. A systematic review was used in the present study to integrate the current knowledge and provide a deeper understanding of the subject matter.

According to Tranfield et al. (2003), a systematic review is the preferred approach due to the replicability of its findings and to its rigour. Also, this approach has been utilised in various studies in the field of construction management. For example, it has been used to uncover the current knowledge in technology applications for construction safety (Zhou et al., 2013), public-private partnership (Ke et al., 2009) and green building incentives (Olanipekun et al., 2016).

This systematic review was carried out in three distinct but interrelated stages. First, a database search was done. Second, the database search was subjected to screening using selection and inclusion criteria. Finally, a content analysis of selected papers was conducted in order to provide answers to the five research questions stated in the introduction section of this paper. These stages are depicted in Figure 1, and the detailed discussions are presented in the subsequent paragraphs.

[Insert Figure 1 here]

***Generating the Sample and Selection Strategy***

The sample for the study was limited to articles published in academic journals. Studies reported in other outlets (such as conferences) were not considered, for the following reasons: (i) lack of access to the full conference paper; and (ii) the outcome of unpublished studies were reported as articles in academic journals. For instance, the outcome of a PhD study by Wang (2008) on apprenticeship training was reported in several journal papers (Wang et al., 2008; Wang et al., 2010). The systematic process utilised in the current study is presented in Figure 1 above, and was carried out in three stages. At the first stage, a database search was carried out to retrieve the biographical details of relevant papers. The search results were screened at the second stage to

remove irrelevant papers. At the final stage, a content analysis of the relevant papers was conducted to provide answers to the five research questions stated in the introduction section of the paper.

### ***Database Search***

A database search was conducted to generate the sample for the study. The search was carried out using the SCOPUS database. There are two main reasons for the use of SCOPUS. First, most of the journal publications in the field of management are archived in the SCOPUS database (Hong and Chan, 2014). In addition, Falagas et al. (2008) assert that SCOPUS provides comprehensive results when compared to other databases, such as Web of Science. The SCOPUS database was therefore used to generate the sample; that is, journal papers, for this study.

In the search, the following keyword combinations derived from the initial ARCOM search were used for the SCOPUS search. The keyword combinations were: "apprentice\*" AND "Construction" AND "industry"; "Vocation\*" AND "train\*" AND "construction" AND "industry"; "trade\*" AND "train\*" AND "construction" AND "industry"; "craft\*" AND "training" AND "construction" AND "industry"; and "skilled" AND "training" AND "Construction" AND "industry". A total of 485 journal papers were returned from the SCOPUS search. From these 485 articles, 324 were excluded due to unsuitability (e.g. conference papers, book reviews and articles published in other languages). A total of 161 published papers remained at the end of the initial screening of the results of the database search.

*Screening of Search Results*

The screening of search results was completed in two phases (initial and final). A total of 485 potentially eligible articles were identified from the databases search. A brief review of the titles and abstracts of the search results was done to remove duplicates and studies that did not focus on the subject matter. At the second stage, the contents (i.e. introduction, results and conclusion) of the 161 articles were read. The inclusion/exclusion criteria were used as a lens for identifying those papers with relevant content. The decision to exclude some studies was relatively easy. However, the authors had to discuss and take a joint decision regarding the inclusion or exclusion of specific studies. Articles were excluded from the search results for the following reasons: (i) subject matter (studies with a focus on “factors that support apprentice training” and/or “factors affecting the outcome of apprenticeship training”): for instance, a study on injuries experienced by apprentice carpenters in the construction sector was removed from the search results (Lipscomb et al., 2006); and (ii) the scope of the review (i.e. 1998-2017). The search took place in 2018, and the search results cover all journal papers indexed in the SCOPUS database.

The journal papers published in 2018 were excluded, for two reasons: (i) papers for what was the current year when this research began were still in the process of being published, and thus there were chances of missing out papers that were yet to be indexed in the SCOPUS database; and (ii) to reduce the likelihood of an overlap between the scope of this review and those carried out in the future. The papers being published in 2018 were therefore removed from the search results. This criterion ensures that the scope of the present study is clear and distinct. As the study by Pringle and Winning (1998) is the first one with a focus on the subject matter of this review, the selected papers cover the period between 1998 and 2017. Thus the study reviewed two decades

of research in this area. Hopefully, the findings will inform future research on apprenticeship training moving into the next decade.

### ***Qualitative Content Analysis***

Upon completion of the screening stage, the resulting pool of relevant studies was reduced to 33 journal papers, which were then subjected to content analysis. Data relating to the pre-defined objectives of the current study were extracted from the selected articles. The extracted data relates to: (i) country (ii) research method (iii) name of publication outlet [journal] (iv) publication date (v) factors that support completion of apprentice training for craftspeople and (vi) factors responsible for low completion rates of apprentice training for craftspeople.

The contents of the selected papers were read in order to identify the ones that addressed the objectives of the current study. Table 1 presents a summary of the selected studies. The study results are summarised and presented in tables (Tables 2-3) and figures (Figures 3-7). Figure 2 provides an insight into the process used to analyse the collected data. The data extracted from the papers was analysed and discussed in the subsequent sections.

[Insert Table 1 here]

[Insert Figure 2 here]

## **RESULTS AND DISCUSSION**

This section presents and discusses the results of the systematic reviews. The first section of the results presents the context; that is, the sources used in aggregating the evidence, while the second section of the results present the contents; that is, the factors influencing the apprentice training programme that were identified from the systematic review. The importance of

establishing the research context cannot be overemphasised in any scientific investigation. According to Tomoaia et al. (2013), establishing the research context not only supports both internal and external validity but also help the researcher to interpret the research finding accurately. In view of this, the contextual information such as the trends in craftspeople training programme research, countries of publication of the research, the names of the journals where the studies were published and the research method used in the investigation were presented in the first part of the results. This was then followed by the actual factors identified from the review of the journals. The contextual information supports the researcher in discussing the findings in section two and in suggesting ta direction for future research.

**Section One - Context**

***Number of articles published per year between 1998 and 2017***

This section addresses the first research question, i.e., provide insights into the trends in published studies on construction craftspeople apprenticeship. Figure 3 presents the number of studies published annually on the subject matter (i.e., apprenticeship for craftspeople in the construction industry). Based on the outcome of the search, it was observed that the seminal studies on this subject matter were published in 1998. Over the last 2 decades (1998-2017), it was observed that a small number of published studies have focused on apprenticeship of construction craftspeople. From Figure 3, it is evident that the number of published work on this topic peaked in 2006-2008.

There are many reasons for the observed trend in this time series plot (Figure 3). First, the number of published studies on apprenticeship of construction craftspeople tends to fluctuate with the macroeconomic climate across the globe. Previous research indicates that economic

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3 recession reduces the demand for construction work (Goh, 2005; Sing et al., 2012). For example,  
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5 global economic crisis was experience in 2008 and this recession may be responsible for the drop  
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7 in the volume of studies published in this area. The trend observed in Figure 3 suggests that there  
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9 is a relationship between construction demand and number of published studies. Between 2016  
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11 and 2017, it was observed that the number of published research on apprenticeship for  
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13 craftspeople in the construction industry has been increasing. This growth could be due to an  
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15 apparent skill shortage associated with the global economy coming out of recession.  
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20 [Insert Figure 3 here]  
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23 The second reason is the recent changes in government regulations relating to training. In the  
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25 UK, the Apprentice Levy was recently introduced (Department for Education, 2018), while in  
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27 the United States of America (USA) an Executive Order to expand the apprenticeship  
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29 programme in the USA was signed the President (The White House, 2017). The current focus on  
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31 craftspeople training suggests that there may be more research and publications focused on  
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33 apprenticeship programmes in the coming year. The amount of time required for training means  
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35 that the impact of increased spending on construction craftspeople apprenticeship on labour  
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37 shortage cannot be immediate.  
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### 41 42 ***Countries of Origin of Selected Studies*** 43 44

45 The second research question seeks to provide insights into the geographical distribution of  
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47 construction craftspeople apprenticeship research. Research outputs, such as academic journals,  
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49 provide a platform for the dissemination of empirical findings to inform policy and improve  
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51 practice (Bilota et al, 2014). Volume of research output and economic growth in any country  
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53 appear to be closely linked (Inglesi-Lotz and Pouris, 2013). Based on research question two, the  
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selected papers were analysed based on country of origin, i.e., geographical distribution. The data presented in Figure 4 shows that the highest number of published research on construction craftspeople training was conducted in the UK, USA and Australia.

Out of these, the UK has the highest number of publications, which suggests that the UK is a leader in construction craftspeople training research. The average age of workers in developed nations, such as the UK, has been on the increase (Powell, 2019). As stated earlier, apprenticeship training programmes for craftspeople were initiated in several countries to address skill shortage in the construction sector. Construction craftspeople training research is largely focused on improving the outcomes of such training programmes through empirical evidence. Additionally, Figure 4 reveals that there is a limited amount of construction craftspeople training research conducted in certain continents such as South America, Asia and Africa. This lack of publications from these continents may be due to the lack of a tailored initiative in those parts of the world.

[Insert Figure 4 here]

**Publication Names**

The third research question was designed to unravel the journals for disseminating construction craftspeople apprenticeship research. Published studies focused on construction craftspeople training has been reported in over 20 different journals. This finding suggests that this research topic, construction craftspeople training, is multidisciplinary. Figure 5 presents the publication (journal) names and the corresponding number of papers published in each journal. Some of these journals were ranked by Naoum and Egbu, (2015) and Wing (1997) as being among the top-tier ones in the field of Construction Management. This journals include *Construction*

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3 *Management and Economics, Engineering Construction and Architectural Management, Journal*  
4 *of Construction Engineering and Management*. The scope of other journals relate to education  
5 and training issues, such as *Education and Training*, the *Journal of Vocational Education* and the  
6 *Journal of European Industrial Training*. Overall, the highest numbers of articles on  
7 apprenticeship training for craftspeople have been published by *Construction Management and*  
8 *Economics*.  
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18 [Insert Figure 5 here]  
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### 20 21 ***Research Method used in Selected Journal Papers***

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23 In response to the fourth research question, the research methods used in construction  
24 craftspeople apprenticeship research were identified. The results, as shown in Figure 6, reveal  
25 that six types of research methods are used in construction craftspeople apprenticeship research.  
26 These methods include interview, questionnaire survey, archival, case study and mixed method.  
27 Also, the number of published studies that used each method is summarised and presented in  
28 Figure 6. Surveys and interviews are found to be the most used research methods in previous  
29 studies that met the inclusion criteria, accounting for 45.71% of the selected papers.  
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40 [Insert Figure 6 here]  
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## 43 **Section Two - Content**

### 44 45 46 ***Success of Apprentice Training Programmes for Construction Craftspeople***

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48 The fifth research question, mentioned in the introduction section, seeks to identify the factors  
49 responsible for improvements in the success (i.e. completion rates) of apprentice training  
50 programmes for construction craftspeople. From the review of the selected journal papers, a total  
51 of 34 factors that support improvements in completion rates of construction craftspeople  
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apprenticeship were identified and presented in Table 2. These factors were grouped into nine core themes, namely (1) mentoring opportunities for craftspeople (2) provision of funding (3) presence of policy and regulatory framework (4) involvement of the stakeholders (5) training approach and structure (6) appraisal and competency assessment approach (7) apprentice training as a social partnership (8) use of virtual reality (VR) and e-learning in training of craftspeople (9) prospects of career progression. The section below presents a discussion of these factor groupings.

[Insert Table 2 here]

*Mentoring Opportunity for Craftspeople*

The study revealed that mentoring opportunity is a significant contributory factor to the success of construction craftspeople apprenticeship programme. In fact, of the 33 journal papers reviewed, mentoring was consistently mentioned in previous studies. For instance, Simon and Clarke (2016), Callan et al. (2015) and Fayek et al. (2003) found that the use of role models in mentoring the apprentices spurs them on to be committed to the training. Mentoring entails the use of tradespeople, such as bricklayers, carpenters and joiners, who have previously completed the scheme to mentor the new entrants. What this means is that the apprenticeship training programme should not be too theoretical. Callan et al. (2015) assert that when the apprenticeship training programme is teaching-centric and rigid, it makes the learner become uninterested in the process.

While it is true that mentoring plays a central role in craftspeople training programmes, mentoring without adequate control and monitoring in place would not yield positive outcomes. In reality, the monitoring should be from the funding agency, the employers and the training providers (Berik and Bilginsoy, 2006), supervisors of on-the-job training (Garlich and Tesinsky,

2005) and adequate recording of mentoring activities (Fayek et al., 2006). However, doing this has its challenges as well as cost implications. Simon and Clarke (2016) found that sustaining such initiatives remains a challenge.

### *Provision of Funds for Training*

Funding is one of the many factors that help to improve the outcome of apprenticeship programmes for construction craftspeople. Researchers have argued that the provision of funds for training is the solution to the current skill shortage faced in the construction industry (Dainty et al., 2004; Muya et al., 2006b). It includes provision of funding by government (Hogarth and Gambin, 2014; Morgan et al., 2008); provision of allowance for the trainees (Abdul-Aziz et al., 2008; Thwala, 2008); provision of scholarship to trainees (Glover and Bilginsoy, 2005) and provision of funding by the employer (Muya et al., 2006b). The last-mentioned factor shows that funding for craftspeople training should not be the duty of the government alone.

However, Muya et al. (2006a) observe that employers are very reluctant to invest in craftspeople training due to the problem of 'poaching'. Poaching is the practice of recruiting workers with the right skills from another organisation rather than training them in-house. According to Zideman (2001), the reluctance of employers to invest in training stems from the lack of control over employee's decisions when compared to capital investment, such as plant and machinery. While there are sufficient reasons for the government to maintain the lead in funding craftspeople training, such as economic and industrial growth (Muya et al., 2006a), and the filling of skill shortage gap, it is important for other stakeholders, such as employers, to fund training programmes as well. It is therefore not surprising that the recent apprentice levy introduced in England requires the employer to contribute adequately (Department for Education, 2018). Other researchers have suggested that employers and trainees should also fund the training, as it would

improve the training outcomes (Muya et al., 2006a; Psacharopoulos and Woodhall, 1985). This perspective stems from the fact that the employers and the trainees are direct beneficiaries so they should contribute.

### *Presence of Policy and Regulatory Framework*

A policy and a regulatory framework are essential for improving the success of apprentice training for construction craftspeople. As reported by different scholars, this entails the government putting forward a policy that supports the training programme (O'Connor, 2006; Simon and Clarke, 2016); having a system in place to regulate the training providers (Anderson, 2014; Muya et al., 2006b) and active support from the regulatory agencies (Anderson, 2014; O'Connor, 2006). Developing the right policy sets the wheels in progress for the sustainable growth of any training programme, including those for craftspeople apprentices.

Bilginsoy (2003) argues that having a policy and regulatory framework in place ensures that all the trainees receive the required skills and training at the appropriate level, which helps to maintain the standard. Similarly, Glover and Bilginsoy (2005) point out that policy and regulatory framework is the government's way of promoting the apprenticeship training programme as it enables it to certify the graduating trainees, monitor the programme and enforces training standards. However, Heraty et al. (2000) observe that in places where the government's role in craftspeople training becomes advisory rather than leading with a clear policy and framework, the process may not work. For instance, Arkani et al. (2003) found that the absence of a clear framework for career progression leads to a drop in the motivation of apprentice to complete the training of craftspeople in the construction sector. However, Glover and Bilginsoy (2005) and Heraty et al. (2000) found that the right policy supported women's access to apprentice training in the USA and the Republic of Ireland. All of these show the

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3 importance of developing and implementing an appropriate policy and regulatory framework to  
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5 address the growing need for adequate supply of craftspeople in the construction sector.  
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### 8 *Involvement of the Stakeholders* 9

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11 The construction craftspeople training programme involves different stakeholders. The  
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13 conflicting interest is attributed to the diversity of stakeholders in the construction project  
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15 environment (Mintzberg, 1995). However, Newcombe (2003) suggests that there is a need to  
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17 integrate the views of all stakeholders involved in the decision-making process. In the context of  
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19 the craftspeople training programme, this entails the employers' involvement and ownership of  
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21 craftspeople training (Garlich and Tesinsky, 2005; Hogarth and Gambin, 2014); having meeting  
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23 events between the trainees, funders, employers and training providers (Gordon et al., 2009;  
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25 Woods, 2012) and stakeholder involvement in curriculum development (Manap et al., 2017).  
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27 The involvement of all stakeholders (trainers, education providers and employers) in process of  
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29 curriculum development ensures that trainees are job-ready at the completion of training. The  
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31 adoption and use of such curricula delivers value.  
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### 40 *Training Approach and Structure* 41

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43 The structure and the approach used in craftspeople training was found to contribute to the  
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45 success of the programme. Manap et al. (2017) and O'Connor (2006) found that work-based  
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47 learning supports the craftspeople training programme. The assessment of trainees should not be  
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49 in the classroom alone. Callan et al. (2015) and Garlich and Tesinsky (2005) found that  
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51 flexibility in teaching and learning support the craftspeople training. These include providing the  
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53 trainees with the opportunity to learn more than one trade in the training process. Anderson  
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55 (2014) and Woods (2012) found that craftspeople apprenticeship training that covers a small  
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spectrum of skill demotivate the trainees. Bilginsoy (2007) and Fayek et al. (2003) observed that giving the trainees the opportunity to engage in varied tasks in the course of the training was seen to be more challenging and kept the trainees focused. However, in the UK craftspeople learn one specific trade at a time while in Germany a trainee can learn more than one trade (Bilginsoy, 2007; Fayek et al. 2003).

Additionally, the structure of training that allows the trainees to relate the theory to the practice keeps them interested in the process (Callan et al., 2015; O'Connor and Harvey, 2001). In developing a training structure and approach for craftspeople, the individual needs of the trainee should be profiled accordingly (Berik and Bilginsoy, 2006). This is essential as it has been observed that a lack of identification of the training needs of craftspeople was found to contribute to the demotivation the trainees (Arkani et al., 2003; Clarke and Herrmann, 2007).

*Appraisal and Competency Assessment Approach*

The uses of varied modes to assess the competence of trainees improve learning experience and completion rates of apprenticeship programmes. Gordon et al. (2009) observed that competency assessment based on practical activities develops the skills of the craftspeople. However, it is vital to complement the practical skills with the theoretical knowledge relating to the trade. According to Fayek et al. (2003), it is essential to develop a standard approach for assessing and measuring the on-job competencies of the craftspeople. In practice, this should include both practical skill and theoretical knowledge. The appraisal process should be structured with milestones and deliverables to keep the trainees focused. Clarke and Herrmann (2007) and Fayek et al. (2006) also suggest that the appraisal process for craftspeople should be not only structured but also regular and consistent.

### *Apprentice Training as a Social Partnership*

Viewing apprentice training as a social partnership – especially by the employers, the local community and the trainees – has been seen to be very important (Anderson, 2014; O'Connor, 2006). Using the perspective ensures that apprentice training programme is viewed as a means of contributing to the local community and to also improving the life of the trainees. For instance, the Public Services (Social Value) Act 2013 requires every business to give back to the community where they operate (Social Enterprise UK, 2012). Daniel and Pasquire (2019) found that the practice of this in the construction industry includes the engagement of apprentices from the local community around the project site. However, it has been found that the practice of this in the construction industry is still low and there is a lack of a clear framework for measuring the social value delivered (Barraket and Loosemore, 2018; Daniel and Pasquire, 2019). Viewing the apprentice training programme as a social partnership by all the stakeholders would enhance the sense of commitment. Additionally, Manap et al (2017) found that the provision of opportunities for extra curricula activities for the trainees, such as engagement in sport, contributed to the successful outcomes.

### *Use of VR and e-learning in Training of Craftspeople*

The construction industry has been adjudged to be slow in embracing innovation, with low investment in research (Oesterreich and Teuteberg, 2016). However, in recent times, the adoption of the digital approach in the construction industry is beginning to gain attention since the emergence of building information modelling (BIM), augmented reality and virtual reality. The use of these new technologies has been associated with improvement in processes in the construction sector. According to Rezgui and Zarli (2006), the construction industry must innovate, for it to remain relevant in today's world.

It is not surprising therefore that VR and e-learning are now used to enhance the training of apprentices (Callan et al., 2015; Tichon and Diver, 2010). The usage of computer aided platforms takes the form of virtual learning environment, online teaching and assessment of the trainees, mixed reality and prototyping of training process using VR. Tichon and Diver (2010) found that the simulation of a process enables trainees to develop a higher level of competence and improve their performance. However, the trainees could be intrigued by the technology and distracted from the learning aspect of the training. Again, this shows it is vital for the use of digital approaches in the training of apprentices to be adequately managed so as not to hinder the trainees from learning. However, this is not to say that the digitalisation of the training process is unnecessary, as studies have shown that it helps in accelerating the training and learning (Bosché et al., 2015; Tichon and Diver, 2010).

***Factors Responsible for Low Completion Rates of Apprenticeship Training***

In order to address the sixth research question (see introduction section), the factors responsible for low completion rates of apprenticeship training programmes for craftspeople were identified. These factors discovered through a comprehensive review of the 33 publications that met the inclusion criteria. The 22 identified factors are summarised and presented in Table 3 and in turn classified and discussed in the subsequent subsections.

**[Insert Table 3]**

### *Classification of factors responsible for low completion rates of apprenticeship training*

Twenty-two factors that increase the non-completion rates of apprentice training for construction craftspeople were identified through a comprehensive review of relevant studies. The classification of these factors would facilitate the understanding of the underlying relationship among these factors. In previous research, the attribution theory has been used as a lens to explain the cause of an outcome (i.e. success or failure). Notably, this theory has been used to explain, for example, factors responsible for air pollution (Cheng et al., 2017) and communication problems (Ejohwomu et al., 2017). Thus a careful examination of the previous literature suggests that factors responsible for the low completion rates of apprenticeship training programmes for craftspeople can be classified using the attribution theory. Based on this theory, therefore, these factors are classified into two groups: internal and external, both of which are discussed in subsequent sections.

#### *External factors*

This grouping is termed external factor because internal stakeholders (apprentices, trainers and training providers) have little or no control over these factors. These factors are mainly under the control of external stakeholders, such as policy makers and employers. Research suggests that individuals tend to attribute failure to external causes (Chang et al., 2016; Franco and Haase, 2010) and this class of causal attribution is referred to by the authors as *self-serving bias*. The external factors identified from literature include: no established training need for craftspeople, training not reflecting the industry skill need, funding issues, lack of operational capacity by construction organisation, employer reluctance to train and invest in apprentices, conflict of interest between college and employer, short project duration, lack of employment prospect, lack of mechanism to engage stakeholders, and lack of clear framework for progression.

Availability of finance is one of the main problems affecting the outcomes of apprenticeship training programmes. In the UK, the net training cost of an apprenticeship for level 2 and level 3 combined in construction is estimated to be around £26,000 (BIS, 2012). There have also been calls for increased funding for apprenticeship training programmes in the US (Lerman and Rauner, 2012) and Hong Kong (Development Bureau, 2012), among others. Although research has shown that non-completion of apprenticeship can be linked to non-availability of finance (Donkor, 2012), it must be noted that increased funding without the requisite synergy among apprentices, training providers and potential employers will not produce the desired outcome.

Collaboration between training providers and employers is essential for addressing skills shortages in the construction sector. Studies have shown that successful outcomes of apprenticeship training for craftspeople can be achieved through close collaboration between potential employers and training providers (Antcliff et al., 2016; Fuller, 1996). This collaboration provides a platform for integrating classroom activities and field experiences. Moreover, this synergy has been attributed to the successes recorded in the USA at the South Carolina Technical College (Stieritz, 2009) and Seminole Community College (Garlich and Tesinsky, 2005). This synergy has the positive effect of ensuring that apprentices are work-ready upon completion of their training.

### *Internal factors*

Internal factors are those factors that are under the control of internal stakeholders. According to the findings of this study, the internal factor grouping consists of 12 different factors, which include 'time required for conducting training' and 'narrow skills demotivate apprentices' (see Figure 7).

Regarding frequency, the ‘time required for conducting training’ is the most reported factor responsible for low completion of apprentice training programmes for craftspeople in the construction sector. Findings from previous research indicate that the duration of the training period affects the completion rates of apprenticeship training programmes (Berik and Bilginsoy, 2000; Coe, 2013). A possible explanation for this outcome could be due to inverse relationship between length of the training period and learning motivation of apprentices (Pelaccia et al., 2009). Furthermore, cost of training and time required to complete apprenticeship are positively related. It is expected that the length of the training period could create financial difficulties for an apprentice if no financial support is provided to reduce the financial burden.

The degree of motivation of an apprentice is vital for the successful completion of their training programme. Previous research shows that motivation has a causal relationship with completion rate, academic performance and student engagement (Johnson et al., 2015; Mega et al., 2014). In addition, the opportunity to gain new skills serves as a motivation for students to learn (Ciampa, 2014). As stated earlier, exposing trainees to a wide variety of tasks associated with their trade could serve as a motivation for completing their training.

[Insert Figure 7 here]

## **DIRECTIONS FOR FUTURE RESEARCH**

In reviewing the literature, a systematic approach was used. The scope of the review covered journal papers published between 1998 and 2017. The proposed research framework was used to address the research questions stated in the introduction section of this paper. The review provided an overview of the trends and gaps identified among the relevant published papers. Based on the insights from the literature review, the pathways for future research were proposed.

These areas for future research were summarised and presented in three main themes, and this information highlighted opportunities to extend the knowledge in this area of research.

***Stage of research*** – Research creates knowledge for improving practice. The stages of knowledge creation have been categorised into description, explanation, prediction and control (Runeson, 2011; Grove et al., 2015). At present, the studies in the area under discussion have mainly focused on describing the factors responsible for the success or failure of apprenticeship training programmes. Simon and Clarke (2016) examined the barriers to women's participation in apprenticeship training programmes in the construction sector. In a similar vein, Wang et al. (2008) assessed major issues affecting craft training in the US. The purpose of this previous research shows that knowledge relating to the outcomes of apprenticeship training for craftspeople is still at its initial phase of development. Hence, little is known about the relationship between the adoption of new methods (such as VR) and training outcomes (i.e. explanation). The identification of the relationship between these concepts provides a solid footing for studies focused on prediction and control. Control is vital for adapting apprenticeship training programmes to produce the desired outcomes. There is a need for studies focused on clarification of these relationships. For example, it is known that long hours of work are a common feature in the construction industry. However, there has been no study focused on the impact of work-life balance on the outcomes of training programmes for apprentice craftspeople.

***Research method*** – Based on the review of previous research, it was found that the questionnaire survey and interview are the most commonly used research method. Also, the overdependence on a cross-sectional approach and methods limits the ability to make causal inferences. The need to address the shortcomings relating to research methods has been acknowledged in the field of construction management. For example, AlSehaimi et al. (2012) suggest that the use of

alternative research methods, such as action research, could provide innovative solutions for addressing schedule overrun in construction projects. Thus in improving the quality of future studies on the outcome of apprenticeship training programmes, the following suggestions are made:

First, there is a need to encourage longitudinal studies, and the samples should facilitate the investigation of internal and external contexts. For example, the study population can include apprentices, graduates of training programmes and training providers. This approach would ensure that the various perspectives are adequately captured. Second, the increased use of alternative research methods, such as ethnography, should be explored in future research. For instance, the use of action research could be used to redesign the teaching methods adopted in training programmes.

**Context** – The findings of the review revealed that over 90% of the previous studies were conducted in developed countries. This seems to suggest that an ageing workforce and labour shortages in the construction sector are not problems in developing countries. Previous research has also shown that the shortage of labour and skills are issues affecting the performance of construction projects in developing countries (Oseghale et al., 2015; Muya et al., 2006b). The rate of completion of apprenticeship training programmes for craftspeople has been low in developing countries as well (Muya et al., 2006a). Financial hardship is one of the main reasons for the non-completion of apprenticeship training programmes for automotive trades in Ghana (Donkor, 2012). In contrast, Gambin and Hogarth (2016) found that it is employment prospects that affect completion rates in England. The findings from these two studies thus indicate that the issues affecting apprenticeship training programmes tend to vary from one location to another.

Further investigations focusing on outcomes of apprenticeship training programmes need to be conducted in developing countries.

## CONCLUSION

Apprenticeship training programmes for craftspeople is a topical issue within the construction industry. Its importance could be attributed to the number of resources committed to apprenticeship training programmes, and to the ageing workforce and labour shortages experienced in the construction industry. A systemic review was conducted in the present study to gain insights into the factors responsible for the outcomes of apprenticeship training programmes for craftspeople in the construction industry, as a better understanding of issues affecting apprenticeship training can help develop strategies for improving its outcomes and improving productivity in the construction sector.

The findings presented in the previous section unearth the trends and gaps in the current knowledge relating to the outcomes of apprenticeship training for craftspeople in the construction sector. Regarding frequency, the study found that monitoring and control is the most mentioned factor that supports the completion of apprenticeship training. In contrast, the time required for conducting training is the most common factor affecting the outcome of apprenticeship training. Concerning geographic distribution, studies have primarily focused on developed countries. The present study also reveals that interviews and questionnaires were the dominant research methods used for data collection in previous studies. Based on the review of relevant studies, three research gaps were identified: namely, the phase of knowledge development (previous studies have focused mainly on describing the problem), overreliance on

specific research methods, and the fact that little or nothing is known about the outcomes of apprenticeship training programmes in developing countries.

The primary scientific value of the current study for the field of construction management lies in its contribution to the existing literature on craftspeople apprentice training programmes in the construction sector. It also contributes to the on-going debate on the need to fill the skill shortage gap in the construction industry. In this regard, first, the findings provide relevant stakeholders (private apprentice training providers, employers and government funding agencies, among others) with the information needed to improve the outcomes of apprentice craftspeople training. Second, the result of the study provides the background information required to inform future research efforts on this subject by construction management scholars.

As in all studies, the limitations of the current research are explained explicitly. First, the search for relevant papers was conducted only through the SCOPUS database. The use of other databases might have produced a slightly different search result. Second, the inclusion and exclusion criteria used for the study meant that the search results were limited to journal papers, while other forms of publications, such as conference papers, were excluded. Third, journal articles published in other languages were not considered for inclusion in the study sample. Finally, the scope of the study was limited to apprentice training programmes for craftspeople in the construction sector. The inclusion of studies on apprentice training for craftspeople in other sectors of the economy might yield a different outcome. Notwithstanding these limitations, the research method used in the current study was explicitly described, and this confirms its replicability and rigour as suggested in Tranfield et al. (2003). It is suggested that further research needs to focus on addressing the gaps in the existing knowledge on this topic.

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**Table 1: Table 1 Summary of relevant studies**

No	Journal	Country	Author(s) and Date
1	Education+ Training	Australia	( <a href="#">Riggall et al., 2017</a> )
2	Journal of Technical Education and Training	Malaysia	( <a href="#">Manap et al., 2017</a> )
3	Engineering, Construction and Architectural Management (ECAM)	New Zealand	( <a href="#">Chang-Richards et al., 2017</a> )
4	Education+ Training	Australia	( <a href="#">Simon and Clarke, 2016</a> )
5	Journal of Computing in Engineering	UK	( <a href="#">Bosché et al., 2015</a> )
6	Journal of Vocational Education and Training	Australia	( <a href="#">Callan et al., 2015</a> )
7	Construction Management and Economics (CME)	UK (England)	( <a href="#">Hogarth and Gambin, 2014</a> )
8	Journal of Education and Work	UK (Scotland)	( <a href="#">Anderson, 2014</a> )
9	Education+ Training	USA	( <a href="#">Woods, 2012</a> )
10	Cognition, Technology and Work	Australia	( <a href="#">Tichon and Diver, 2010</a> )
11	Desalination Journal	UK (Scotland)	( <a href="#">Gordon et al., 2009</a> )
12	Journal of Construction Engineering and Management (JCEM)	USA	( <a href="#">Wang et al., 2008</a> )
13	Construction Management and Economics (CME)	USA	( <a href="#">Wang et al., 2010</a> )
14	Development in Practice	South Africa	( <a href="#">Thwala, 2008</a> )
15	International Journal of Training and Development	UK (South Wales)	( <a href="#">Morgan et al., 2008</a> )
16	Journal of Engineering, Design and Technology (JEDT)	Malaysia	( <a href="#">Abdul-Aziz et al., 2008</a> )
17	Construction Management and Economics (CME)	Zambia	( <a href="#">Muya et al., 2006b</a> )
18	Engineering, Construction and Architectural Management (ECAM)	Zambia	( <a href="#">Muya et al., 2006a</a> )
19	Construction Management and Economics (CME)	UK	( <a href="#">Kappia et al., 2007</a> )
20	Personnel Review	UK	( <a href="#">Clarke and Herrmann, 2007</a> )
21	Industrial Relations: A Journal of Economy and Society	USA	( <a href="#">Bilginsoy, 2007</a> )
22	Journal of Vocational Education and Training	Ireland	( <a href="#">O'Connor, 2006</a> )
23	The International Journal of Human Resource Management	UK(N. Ireland)	( <a href="#">McGuinness and Bennett, 2006</a> )
24	Canadian Journal of Civil Engineering	Canada	( <a href="#">Fayek et al., 2006</a> )
25	International Journal of Manpower	USA	( <a href="#">Berik and Bilginsoy, 2006</a> )
26	Education+ Training	USA	( <a href="#">Glover and Bilginsoy, 2005</a> )
27	Community College Journal of Research and Practice	USA	( <a href="#">Garlich and Tesinsky, 2005</a> )
28	Canadian Journal of Civil Engineering	Canada	( <a href="#">Fayek et al., 2003</a> )

29	ILR Review	USA	<a href="#">(Bilginsoy, 2003)</a>
30	Journal of Vocational Education and Training	UK ( Jersey Channel Island)	<a href="#">(Arkani et al., 2003)</a>
31	Journal of European Industrial Training	Ireland	<a href="#">(O'Connor and Harvey, 2001)</a>
32	Construction Management and Economics (CME)	UK	<a href="#">(Clarke and Wall, 2000)</a>
33	Gender, Work and Organization	Australia	<a href="#">(Pringle and Winning, 1998)</a>

Education + Training

**Table 2** Factors that Support Craftspeople Apprentice training

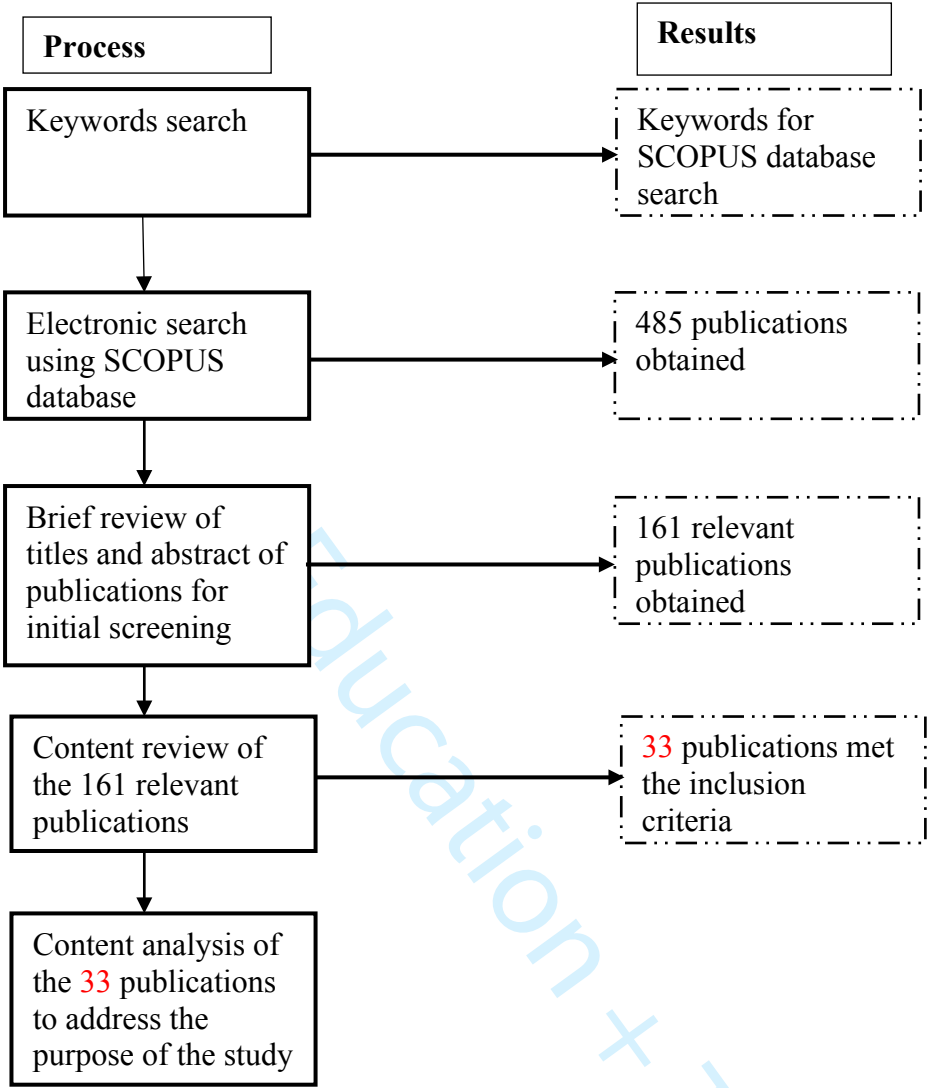
Grouping	Label	Factors that Support Craftspeople Apprentice training	Authors
G1		Mentoring Opportunity for Craftspeople	
	F1	Monitoring and control	[7, 25, 22, 25, 28, 28, 11]
	F2	Use of role model and mentoring	[4, 6]
	F3	Involving tradesmen mentoring of trainees	[28]
G2		Provision of Funds for training	
	F4	Government provision of funding	[7, 15, 34, 18]
	F5	Provision of allowance for trainee	[14, 32, 16]
	F6	Provision of scholarship for trainees	[27, 25]
	F7	Provision of funding from employer	[18]
	F8	Construction industry to contribute to government funding	[18]
G3		Presence of Policy and Regulatory Framework	
	F9	Government policy, regulation and programmes	[4, 8, 25, 22]
	F10	Regulation of training provided	[18]
	F11	Active support from regulatory agencies	[22]
G4		Involvement of the Stakeholders	
	F12	Employer involvement and ownership of craftspeople training	[7, 18, 27]
	F13	Good collaboration with the main contractors	[27, 30]
	F14	Clear communication and good relationship with the all the stakeholders involved	[15, 27]
	F15	Meeting and network event with trainee, funders, employer and education providers	[9, 11]
	F16	Stakeholder involvement in curriculum development	[2]
G5		Training Approach and Structure	
	F17	Project-based learning approach	[7, 22, 2, 24]
	F18	Exposure of apprentice to varied tasks during the programme	[21, 28]
	F19	Training structure	[29, 31]
	F20	Provision of training opportunities for the craftspeople	[11, 24]
	F21	Frequency of training	[12, 15]
	F22	Flexibility in teaching and learning approach	[6, 27]
	F23	Meeting individual training needs	[25]
	F24	Inclusion of managerial and costing in training	[14]
G6		Appraisal and Competency Assessment Approach	
	F26	Competency based assessment of practical skill rather than exams	[11, 28]
	F27	Regular appraisal of craftspeople	[20, 24]
	F28	Certification and quality of training	[30]
G7		Apprentice Training as a Social Partnership	
	F29	Viewing apprentice as social partnership	[8, 22]
	F30	Provision of extra curriculum activities such as sport	[2]
G8		Use of VR and e-learning in Training of Craftspeople	
	F31	Use of virtual reality in training and virtual learning environment	[6, 10]
	F32	Use of IT and e-learning	[6, 7]
G9		Prospect of Career Progression	
	F33	Career progression and as a pathway to higher degrees	[9, 24]
	F34	Job prospect opportunities	[29]

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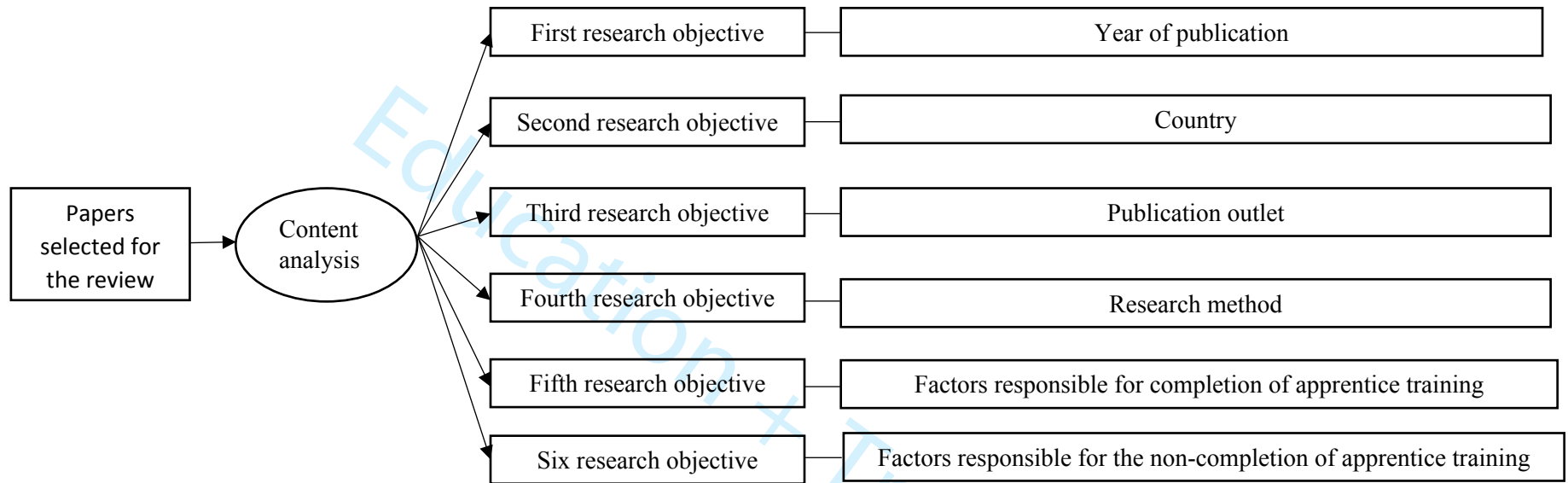
Education + Training

**Table 3** Factors affecting the outcome of apprenticeship training for craftspeople

Label	Factors	Publication
L1	Time required for conducting training	[1, 3, 15, 12]
L2	No established training need for craftspeople	[20, 30]
L3	Training not reflecting the industry skill need	[23, 30]
L4	Funding issues	[12, 30]
L5	Lack of operational capacity by construction organisation	[3, 30]
L6	Employer reluctance to train and invest in apprentice	[7, 13]
L7	Conflict of interest between college and employer	[8, 12]
L8	Narrow skills demotivate apprentice	[8, 9]
L9	Teaching centric approach and lack of mindset change	[6]
L10	Short project duration	[7]
L11	Rigid approach to training	[6]
L12	Lack of employment prospect	[14]
L13	Craftspeople not accepting formal training	[13]
L14	Quest for quick earning for trainee rather than career progression	[23]
L15	Going to apprentice for the sake of learning main stream education system	[23]
L16	Lack of mechanism to engage stakeholders	[15]
L17	Inadequate instructors and supervisors	[12]
L18	Lack of adequate training facilities and resources	[12]
L19	Gender stereotype in training	[14]
L20	Craftspeople training acceleration	[21]
L21	Bullying of craftspeople	[1]
L22	Lack of clear framework for progression	[30]



**Figure 1** Flow chart of the research process



**Figure 2** Conceptual model used for the qualitative analysis of the selected studies

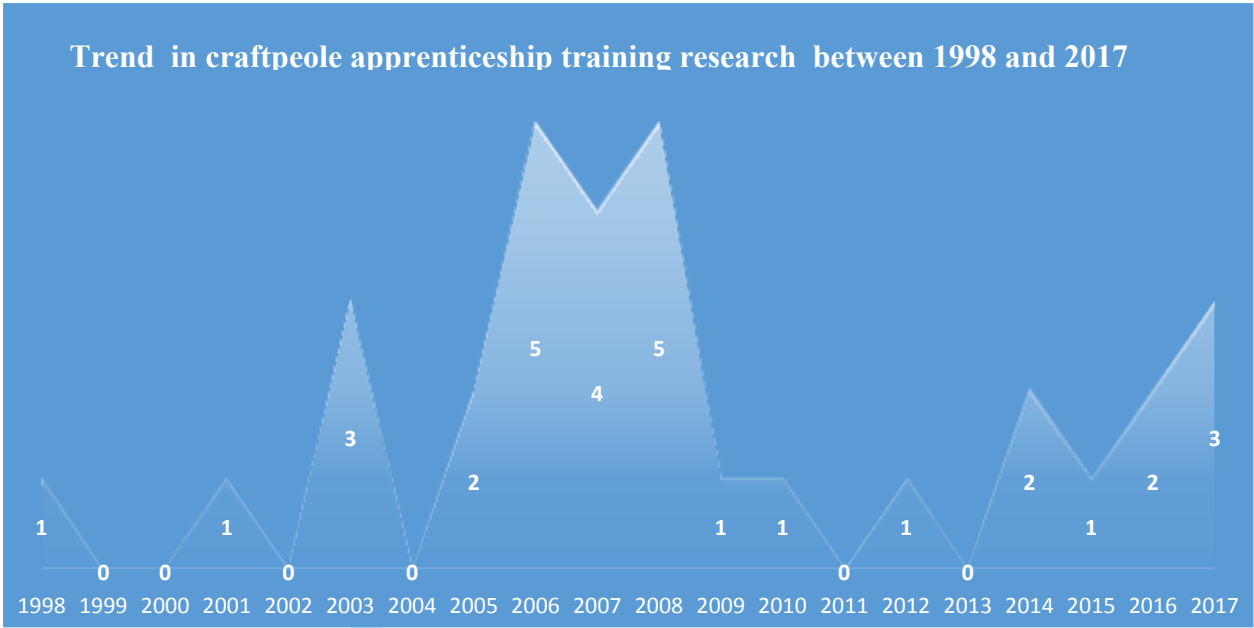
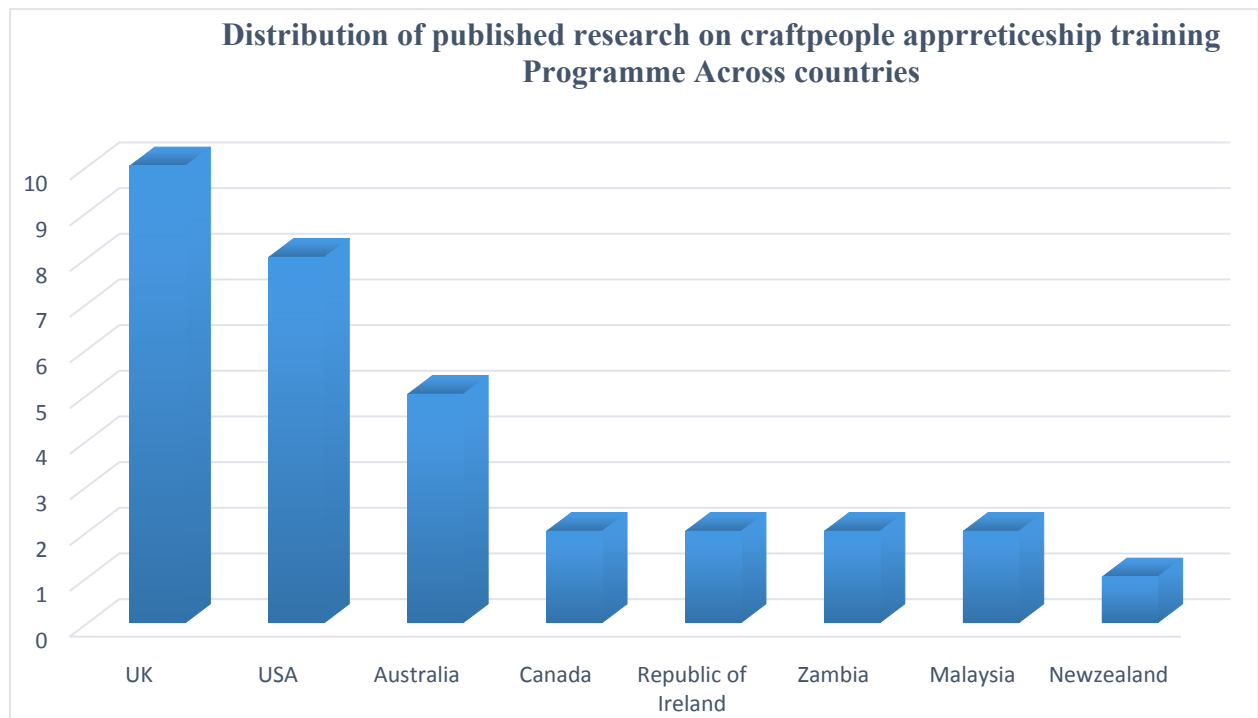


Figure 3 annual trends of relevant publications



**Figure 4** Distribution of craftspeople research across countries

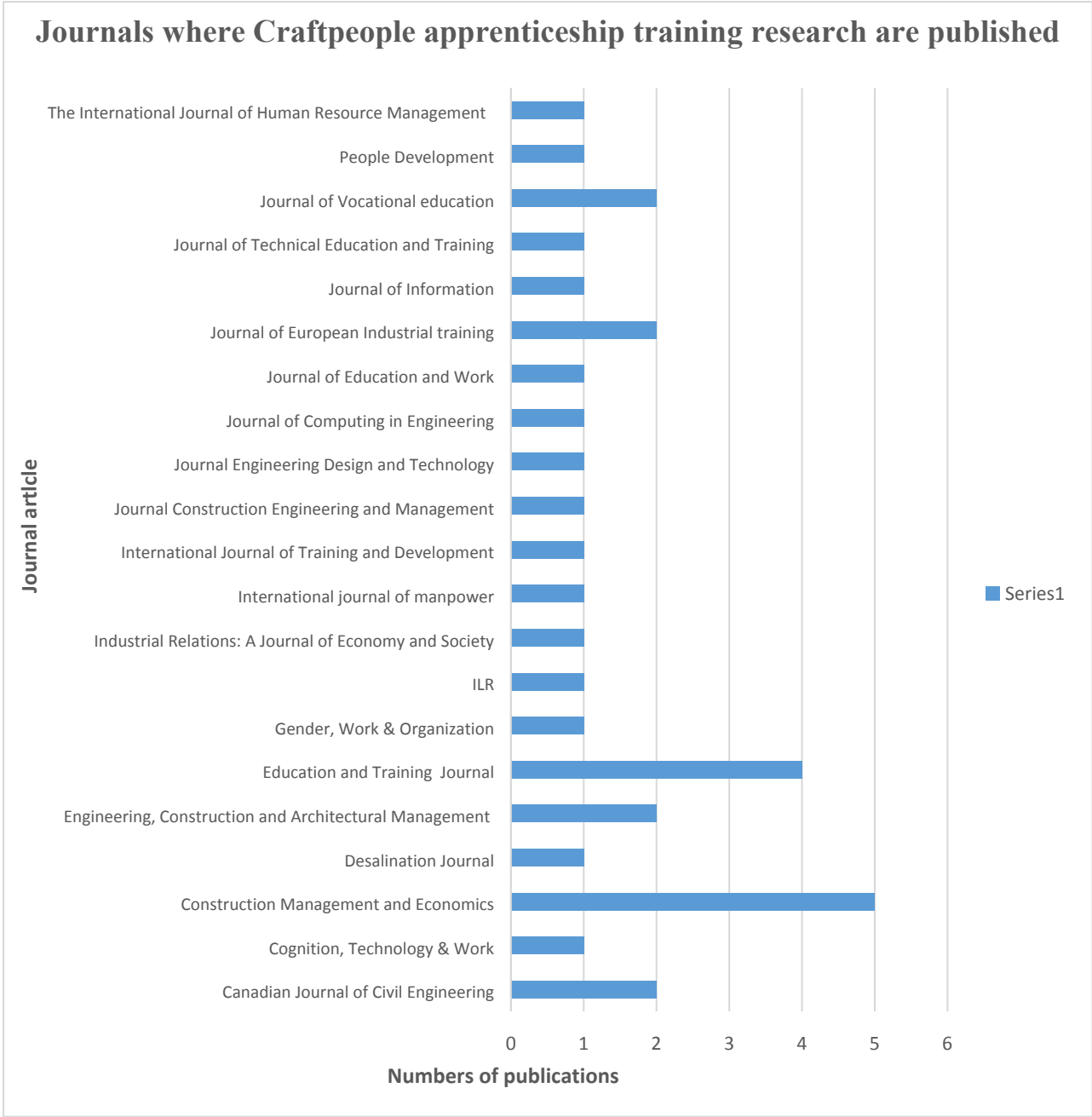
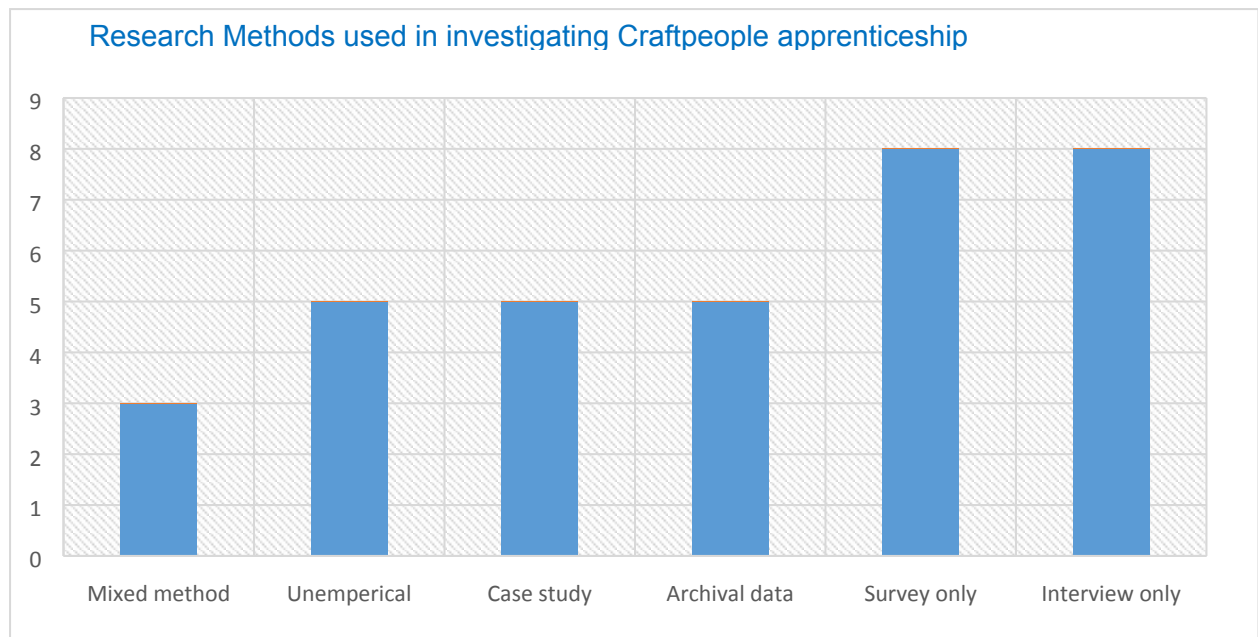
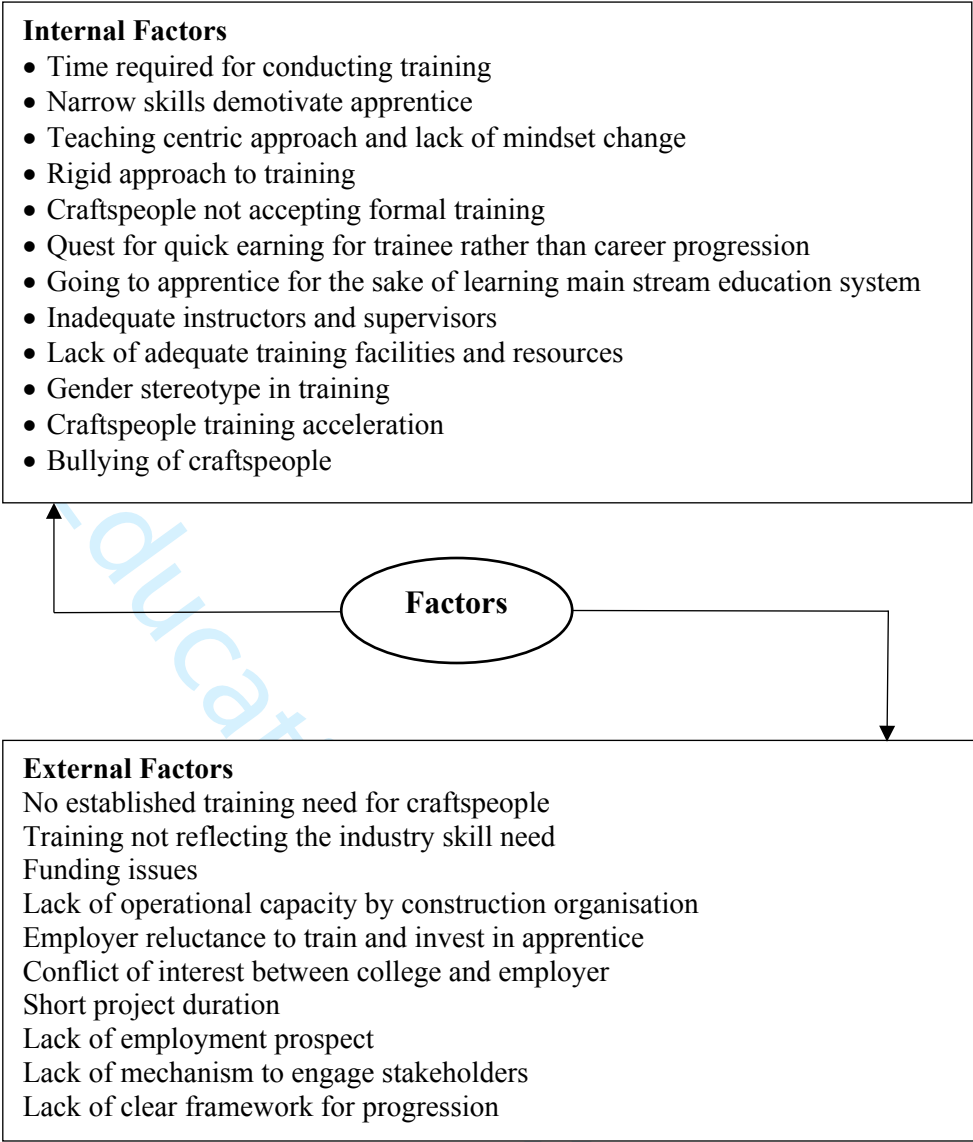


Figure 5 Journals where Craftspeople research is published



**Figure 6** Research method used in selected journal papers



**Figure 7** Conceptual framework for classification of factors that negatively affects the outcome apprenticeship training