



The Impact of Tertiary Education on Development

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List of Abbreviations

CHET	Centre for Higher Education Transformation
DFID	Department for International Development (UK)
FDI	foreign direct investment
GDP	gross domestic product
HCT	human capital theory
LLMIC	low- or lower-middle-income country
MOOC	massive open online course
NGO	non-governmental organisation
OECD	Organisation for Economic Co-operation and Development
R&D	research and development
ROR	rate of return
SME	small and medium-sized enterprises
TE	tertiary education
TEI	tertiary education institution

Executive summary

After a long period in which the international development community has placed emphasis on primary education, there is now renewed interest in tertiary education (TE). However, the extent and nature of the impact of TE on development remains unclear. This rigorous review seeks to address this question in the context of low- and lower-middle-income countries (LLMICs).

Overall, while there is a large body of literature on TE in LLMICs, the majority of studies focus on the characteristics of TE systems and institutions, or on the short-term effects of interventions (for example, on policy and funding arrangements). We found relatively few studies that sought evidence of the broader impact of TE on development in LLMICs.

A conceptual framework was developed in order to structure the review of literature. Drawing on theories relating TE to human capital development, endogenous development, capabilities and institutional growth, multiple potential pathways to impact were identified. These pathways lead to improvements in five forms of outcome: earnings, productivity, technological transfer, capabilities and institutions.

A rigorous review of relevant literature was undertaken, drawing on the principles of framework synthesis. After a search of bibliographic databases, institutional websites and existing literature reviews, the 6,677 studies identified were screened on title and abstract, and, subsequently, a reduced number (668) screened on full text. Included studies had to meet the criteria of providing empirical evidence of the impact of TE, relating to LLMICs; be in English; and have been published since 1990. Following this stage, 147 studies were identified as being relevant to the main research question. All studies were then appraised for quality (data source, sampling, rigour of analysis, soundness of conclusion, etc.); a further 48 studies were consequently excluded on the basis of lack of methodological rigour.

For the purpose of analysis, the 99 included studies were categorised according to five outcomes: earnings (66),¹ productivity (13), technology transfer (8), capabilities (24) and institutions (13) (some studies were placed in more than one category). The majority of the studies related to earnings and productivity, and were econometric in nature, using panel data for multiple countries and cross-sectional data for single-country studies. There were a smaller number of studies relating to technology transfer, capabilities and institutions, involving a range of quantitative observational, qualitative and mixed-method approaches. Most of the research related to teaching and learning at tertiary level; there were few studies showing the impact of the research and service functions of tertiary education institutions (TEIs). In terms of regional spread, the majority of studies focused on Sub-Saharan Africa and South and South-East Asia—in particular on India, Pakistan, Nigeria, Kenya and Tanzania; there were a very small number of studies on LLMICs in Latin America, North Africa and the Middle East, and the Pacific Islands.

¹ Of these, 48 exclusively address individual earnings while 25 extend the analysis to consider economic growth

We found strong evidence of TE impact on the earnings of graduates in LLMICs. In terms of macro-level economic benefits, there is evidence that TE has a stronger impact on growth than was previously assumed. The impact of TE on income equality is more difficult to isolate and appears to vary significantly, depending on context. There is some evidence to suggest that TE has a positive impact on productivity in the workplace, but the relationship is not conclusive. Evidence of economic impact is most robust at the individual level, with macro-level relationships being harder to identify, largely due to methodological differences between studies and likely barriers to impact in many contexts. Studies indicate that research output in lower-income countries is generally low and that there is limited transfer of technology to firms. There is some evidence to suggest that an increase in the proportion of workers with higher education may increase the likelihood of technological adaptation. There is also limited evidence of local impact through technological transfer to small- and medium-sized enterprises (SMEs).

A number of studies show a positive impact of tertiary-level study on graduates' capabilities and the strengthening of institutions (both formal organisations and social norms). Impact was shown in areas of health, nutrition, gender equality, democratisation and the environment. However, the studies included were dispersed across a broad range of different forms of benefit, and further research is needed.

The following table summarises the available evidence in terms of the categories proposed by DFID (2013):

Table 1: Strength of evidence summary table

OUTCOME	CHARACTERISTICS		
	SIZE	CONSISTENCY	OVERALL STRENGTH OF EVIDENCE
Individual earnings	Large (48)	Consistent	Strong
Economic growth	Medium (25)	Consistent	Medium
Productivity	Small (13)	Inconsistent	Limited
Technological transfer	Small (8)	Inconsistent	Limited
Capabilities	Medium (24)	Consistent	Medium
Institutions	Small (13)	Consistent	Medium

Caution is required in interpreting these findings. The pathways to impact identified in the original conceptual framework rest on certain assumptions, including: sufficient primary and secondary education; sufficient quality; academic freedom; and equality of access and opportunities within TE. As these conditions rarely hold in LLMICs, the lack of impact observed in some studies may not indicate a lack of validity of the pathway in question, but may be the result of certain barriers within the system, such as poor-quality teaching

and curricula, or the lack of a conducive research environment. While there is a large body of literature analysing these barriers (517 studies were identified by this study), research needs to be conducted into how impact (or lack of it) is linked to changes in these potentially limiting factors.

A supplementary mapping was made of studies identified in the database search that investigate TE interventions funded by external agencies in LLMICs. These were not included in the main review, as they did not gauge the impact of the interventions on societal development. The studies were mapped according to their focus: for example, provision of short-term training; institutional capacity building; creation of networks; and the development of distance education. An overview of the studies suggests that the principal areas of intervention do not coincide with the principal barriers to impact facing TEIs in LLMICs. However, a systematic review of these interventions is needed.

The literature identified by this review is heterogeneous in terms of focus, research design and geographical context. A number of challenges are presented in showing conclusive evidence of the impact of TE, not least of which is the significant time-lag involved between interventions and likely development outcomes, even if they can be accurately measured. Nevertheless, evidence of a range of positive outcomes and likely impacts was identified across diverse contexts.

Drawing together the specific points discussed above, we derive three main conclusions from the review:

1. There is a significant lack of research into the impact of TE on development. Studies are needed, in particular, to show how inputs and interventions to TEIs and systems are related to different forms of outcome and levels of impact.
2. The returns to TE have been underestimated. There is evidence to suggest that TE may provide greater impact on economic growth than lower levels of education. However, all levels of education are interdependent and must be addressed holistically.
3. TE provides a range of broader, measurable benefits to graduates, relating to health, gender equality and democracy, among other areas. In addition, it contributes to the strengthening of institutions, and the forming of professionals in key areas, such as education and healthcare. The diverse functions of the university, in addition to its direct impact on economic growth, should be acknowledged and supported.

1. Introduction

1.1 Aims and objectives of the review

This rigorous review seeks to answer the question: *What is the impact of tertiary education (TE) on economic growth and development in low- and lower-middle-income countries² (LLMICs)?*

In the immediate post-independence period, tertiary education (TE) in low- and middle-income countries received a substantial amount of domestic and external investment. However, interest in TE waned significantly in the 1980s and 1990s, causing a ‘crisis of quality’ in many systems across the developing world. In recent years, global changes in the context of the emerging ‘knowledge economy’ have stimulated a renewed interest in TE in low-income countries. This has led to a wave of reform and revitalisation efforts, as well as a growing interest in how it might be possible to capture the impact of TE investment on economic growth and development.

Despite this interest, there are currently no literature reviews available that consider the impact of TE on comprehensive development outcomes in low- and lower-middle-income countries (LLMICs). The Center for Higher Education Transformation (CHET) in South Africa recently produced a review of the topic (Pillay 2011), but it focuses solely on economic development outcomes. Other relevant resources include: a systematic review by Hawkes and Ugur (2012), which considers the impact of education and skills on economic growth; the introductory chapter to Cloete et al.’s (2011) study of universities and economic development in Africa; and a recent journal article outlining how higher education contributes to economic growth (Kimenyi 2011). Although each of these resources offers important insight into the scope of literature available, none explicitly considers the empirical and theoretical evidence linking TE and non-economic development outcomes. Furthermore, most of the reviews available consider the full range of international evidence linking TE and development, including studies from the Organisation for Economic Co-operation and Development (OECD), rather than focusing solely on LLMICs³. Among the available reviews, the Hawkes and Ugur study is the only one to take a systematic approach.

The current review aims to fill the resulting gap by rigorously analysing the empirical evidence of TE impact on a comprehensive range of development outcomes in LLMICs. The study is intended both to contribute to the ongoing debate around the role of TE in LLMIC contexts and to expose gaps in the existing evidence base.

1.2 Definitional issues

We have used the term ‘tertiary education’ throughout the review to refer to formal educational institutions that ‘build on secondary education’ (UNESCO 2011). This category of institution includes universities, medical and business schools, polytechnics and technical colleges, teacher-training colleges and two-year further education institutions.

² Although we initially intended to consider all low- and middle-income contexts, upper-middle-income countries were removed from the scope of the review during the search process. An explanation for this decision can be found in Section 3.

³ The exception is the chapter by Cloete et al., which considers the African context.

Formal post-secondary technical and vocational training, leading to either a diploma or a degree certificate, has also been included in the scope of the review.

The terms ‘economic growth’ and ‘development’ are often used interchangeably, but are here treated as distinct concepts. Evidence of economic growth is assumed to be measurable through per-capita GDP. Development, however, is assumed to include both economic and non-economic elements. Our definition of development incorporates a wide range of desirable outcomes beyond strict improvement in GDP, including poverty reduction, increased income equality, improved health, literacy, access to high-quality primary and secondary education, civic participation, good governance and the protection of human rights. Environmental protection was also conceptualised as an important development outcome for the purposes of the review. We assume that economic growth and development are interrelated concepts, as increases in growth are likely to contribute to development, while improvements in a wide range of development indicators are likely to lead to growth.

The review also takes a broad conceptualisation of the term, ‘impact’. Rather than restricting our search to studies that use an experimental or quasi-experimental methodology, we chose to include studies that use a wide range of empirical methods to examine causal pathways between development outcomes and TE. As TE is not an ‘intervention’ *per se*, attribution is difficult, but we did find that it was possible to identify literature empirically investigating the link between TE and developmental change.

1.3 Report outline

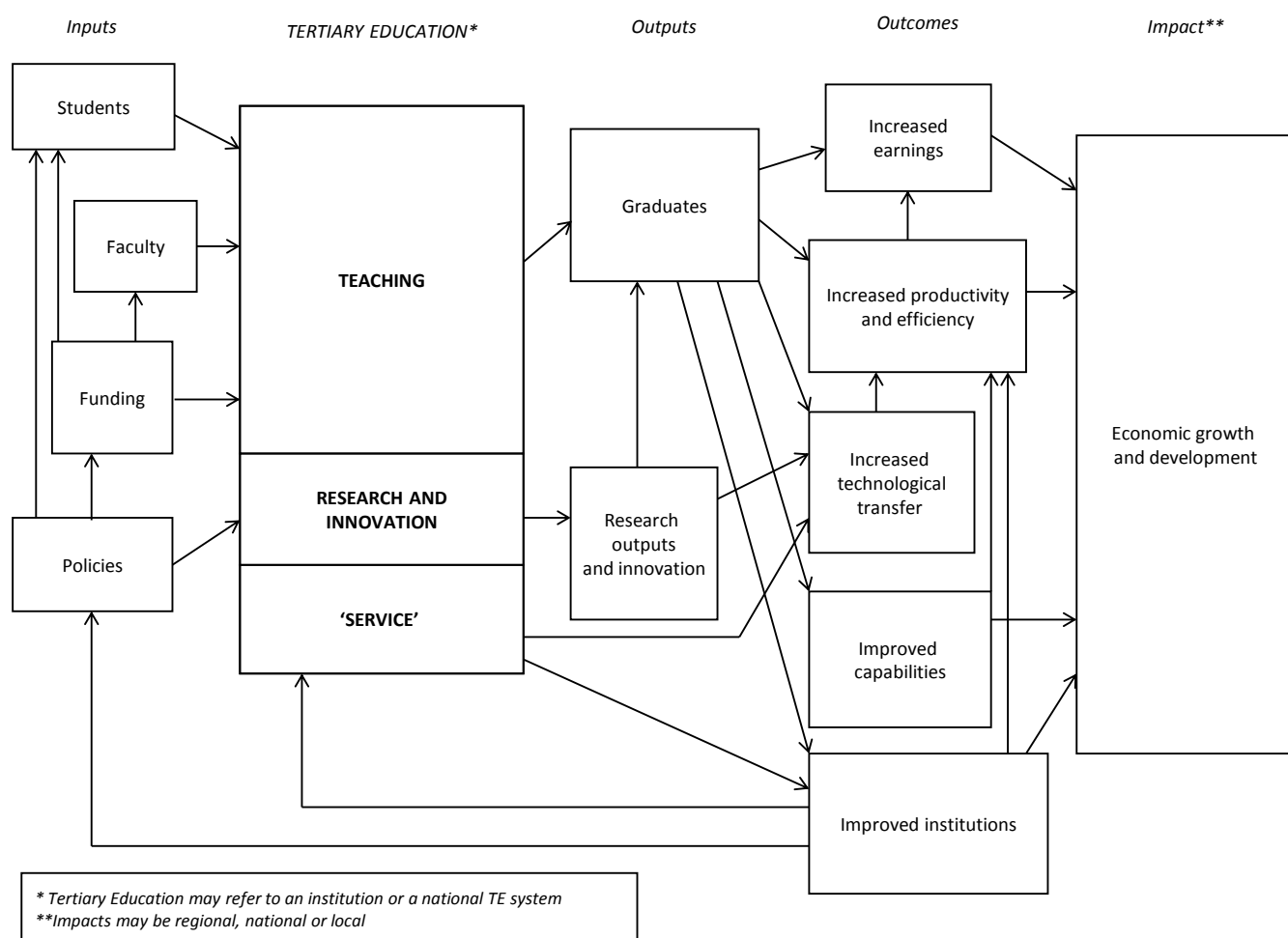
This report presents the review findings and discusses the implications for future research. It begins with a discussion of the conceptual framework used to guide the study, before outlining the methodology used to select and screen evidence. The study findings are then presented thematically. In addition to analysis of the synthesised evidence, there is a supplementary discussion of the barriers to impact. The report also includes a brief analysis of how external aid to TE in LLMICs has been used in attempts to increase the impact of the sub-sector. A discussion of the implications of the study findings concludes the report.

2. Conceptual framework

The diversity of theories prevalent in the literature on TE and development necessitated the creation of an overarching conceptual framework that could be used to guide the review team’s decisions regarding the identification, selection and analysis of evidence. Our framework draws on the relevant theoretical paradigms and articulates a conceptually consistent understanding of how TE contributes to development in different contexts. As much of the literature on TE relies on evidence from high- and upper-middle-income countries, the framework reflects a number of assumptions that do not hold in most LLMICs. It was, therefore, clear from the outset that there would be significant limitations on the applicability of the framework to the contexts of interest in this review. As a result, the current framework was adopted, not as a definitive statement, but as a useful ‘working hypothesis’ that could be used to guide the identification and analysis of the available literature (Oliver et al. 2012, p 73). As an outcome of the study, we intended to incorporate the study findings into a revised framework that would more accurately reflect the pathways to impact evident in lower-income contexts.

A visual representation of this conceptual framework is presented in Figure 1, below:

Figure 1: Conceptual framework



In this section, we will discuss the pathways to impact depicted in the conceptual framework and elaborate on the underlying assumptions that affect the functioning of these pathways. We will also situate the central theories in historical context, in order to give some critical background to the central findings of the review.

2.1 Pathways to impact

The framework outlines three major pathways through which TE impacts development: a pathway through teaching; a pathway through research and innovation; and a pathway through service. These three pathways relate to the three central functions or ‘pillars’ of the university: teaching, research and ‘service’—the last of these referring to the direct engagement of institutions with the local community and broader society, involving knowledge sharing, exchange and dissemination, and service provision (Knight 2004). Although some individual TEIs may concentrate on only one pillar, such as teaching, others may include all three. The diagram assumes that a differentiated TE system would involve a range of institutions, representing all three pillars of TE, but ‘teaching’ has been given extra weight in the diagram, given that many TEIs in LLMICs are not research-intensive institutions.

Within these major pathways, a number of individual change pathways are articulated. For instance, within the pathway through teaching, there are five discrete sub-pathways: one through increased earnings of graduates; one through increased productivity; one through technological transfer; one through increased ‘capabilities’ of graduates; and one through improved institutions. There is some interaction between the pillars, illustrated by the internal (vertical) arrows.

Although there are many inputs to TE, four were selected as critical: students, faculty, funding and policies. The model assumes that policies can both directly influence the functioning of TE and indirectly influence the sub-sector, through funding and access policies (represented by the vertical arrows). Although the arrows depicting the pathways to impact explicitly link particular pillars (that is, teaching, research or service) to their intended outcome(s), the arrows leading from inputs to TE are not meant to imply that individual inputs affect only certain pillars. We assume that students, faculty, funding and policies are inputs relevant to all of the functions of TE.

The end-point of each pathway is ‘economic growth and development’. This is represented in the diagram as a unified concept, given the interrelationship between growth and other development indicators discussed in Section 1.2. This depiction is not meant to imply that there is only one type of impact that may be evaluated. Rather, our framework assumes that the interrelationship of development outcomes makes it inappropriate to depict impact as a series of disconnected pathways. Although some of the pathways represented in the framework may influence only one aspect of development, such as increased GDP, others may have an impact on many different components of development. For instance, improvements in institutions may have an indirect impact on economic development by improving the enabling environment for economic growth, while also having a direct impact on other outcomes, such as improved health or civic participation. We suggest, therefore, that the development impact of TE outcomes is best examined through the contributions of TE to a wide range of interrelated development goals.

2.1.1 Pathways to impact through teaching

The literature on TE and development focuses primarily on the first pillar of TE: teaching. Although there are many different explanations as to how human capital contributes to development, all rest on the assumption that graduates have an impact on development outcomes. Human capital theory (HCT) has been a dominant paradigm informing this pathway (Becker 1965, Schultz 1961). However, more recent work focusing on endogenous growth (Lucas 1988, Romer 1986), endogenous development (Hu 2008, McMahon 2009, McMahon and Oketch 2013) and the development of capabilities (Boni and Walker 2013, Sen 1999) also provides important insights into how graduates of TE contribute to growth and development.

A. Impact through increased productivity and earnings

The degree to which TE impacts growth and development through earnings has long been a contentious area in the economics literature. It is not a straightforward pathway to impact, as the particular nature of inputs into a TE system (such as funding and student enrolment) can substantially affect outcomes. However, its dominance within the discourse—and the role that it has played throughout history in defining the debate around TE investment—makes it a pathway that it is crucial to consider.

In the post-independence era, national universities were established in many countries as part of broader nation-building initiatives. Although universities were often supported domestically for their symbolic value, as they were seen to represent the arrival of newly independent nations on the international stage, external aid for TE was largely justified by adherence to the central tenets of HCT. In its most basic conceptualisation, HCT suggests that education increases worker productivity and that those with more education should earn higher wages in exchange for this higher productivity (Becker 1965, Schultz 1961). HCT, therefore, assumes that investment in TE yields a private return, as it benefits individuals through increased earnings, and a social return, as it benefits the national economy through economic growth, resulting from higher worker productivity. However, in the late 1980s and early 1990s, a series of rate-of-return (ROR) analyses, conducted by education economists at the World Bank (for example, Psacharopoulos et al. 1986, Psacharopoulos 1994), cast doubt on the applicability of this theory to developing countries. The results of the Bank's calculations suggested that private returns to investment in TE were significantly higher than social returns. Furthermore, the calculations indicated that the social return on investment in primary education was double that of investment in TE in low-income contexts. These results were used to justify reduced public funding of TEIs in favour of primary education in lower-income contexts, an approach that was solidified as explicit policy when universal primary education was adopted as the central educational objective of the international community in 1990 (Haddad et al. 1990).

In recent years, the results of the Bank's calculations have received substantial criticism (see, for example, Bennell 1996). In addition to concerns about the data used and the assumptions made around opportunity costs to TE, contemporary researchers have questioned the validity of using a 'narrow' method to calculate return on investment in education. The Bank's calculations relied entirely on earnings. Externalities, such as increased tax revenue, increased savings income and investment, decreased reliance on

public benefits, and increased consumption levels, were not included (Bloom et al. 2006), nor were any non-market private and social returns arising from TE. Recent 'total-rate-of-return' studies, which have included these benefits (for example, McMahon and Oketch 2010), have found evidence of a substantially higher social ROR to TE.

Another rationale for reduced TE investment in the 1980s and 1990s was the impact of TE on increasing socio-economic inequality. TE is a scarce good in many low-income contexts, with diplomas conferring positional advantage over others in society. As merit-based admission to TE tends to disadvantage certain groups (Brennan and Naidoo 2008), TE can contribute to a cycle of intergenerational reproduction of inequalities in society. It is important to recognise that the financing of TE can significantly influence the impact of TE on inequality. Some contexts have addressed the issue of elite capture of the benefits of TE by charging students for tuition, room and board. Although this reduces the public-subsidy element, the introduction of tuition fees can also contribute to increasing inequality, as it can lead to a situation in which only wealthy students are able to afford TE (Oketch 2003). The provision of need-based scholarships, in contrast, can positively influence income inequality, as a wider proportion of the population is given the opportunity to access TE and, consequently, earn higher wages. TE has, in fact, been found to contribute to reduced inequality in contexts with a high proportion of tertiary enrolment and where state-financed support of higher education is not based on highly regressive taxes (McMahon 2009).

Since the 1990s, economic arguments for investing in TE have returned to the discourse, as a result of shifts in the nature of production associated with globalisation and the rise of the 'knowledge economy'. Endogenous growth theory, in particular, has emerged as an important theoretical explanation for how TE contributes to development, expanding beyond the traditional relationship between productivity and income. Endogenous growth assumes that highly skilled personnel are a prerequisite for growth in the context of the knowledge economy, not just because they earn higher wages, but because such personnel are required in order for adaptation and transfer of technology to occur (Lucas 1988, Romer 1986). Technological transfer, meanwhile, is assumed to increase the productivity and efficiency of the economy, leading to sustained economic growth. One aspect of endogenous growth is innovation and the development of new technology. This will be discussed in more detail in relation to the research function of TE in sub-section 2.1.2. However, the teaching function is also a relevant component of endogenous growth. New technologies cannot be adapted to local conditions unless there are educated members of the workforce familiar with current research and innovation.

McMahon (1999) has expanded the concept of endogenous growth into a wider theory of endogenous development. McMahon's work indicates that, in addition to market benefits through earnings, TE contributes to improvements in the quality of life and life chances for the individual through non-market benefits (that is, the benefits of TE that can be observed during non-labour-market hours). Data indicate that higher levels of education yield a number of non-market private benefits, including improved health (for both individuals and their family members), greater longevity, improved cognitive development in children, and reduced family size (McMahon and Oketch 2013). These outcomes are likely to contribute to the productivity of individuals in the workforce, and, consequently, to economic growth.

B. Impact through increased capabilities

A second pathway to impact considers how TE can increase capabilities within a population. This pathway is largely informed by the capability (or ‘capabilities’) approach, emerging from the work of Amartya Sen (1992, 1999, 2009), which posits that gauges of individual well-being and national prosperity based on income are inadequate, and that the focus of our evaluations should be on people’s freedoms to do or be what they have reason to value. Income is seen as being instrumental in expanding freedoms, but not a sufficient condition. The capabilities approach suggests an alternative pathway to impact, with TE providing a broad learning experience for students, which equips them to pursue diverse goals, including, but not restricted to, employment, and strengthens citizenship and ethical commitments to others in society (Nussbaum 1997, Walker 2006).

The notion of capabilities is closely associated with the ‘human development’ paradigm, which directs attention to a broad range of development outcomes, such as health, longevity, literacy and respect for human rights, and, importantly, places participation at the heart of the process. These outcomes have a positive economic impact, but can also be viewed as development indicators in their own right. The non-market private benefits (for example, improved individual and family health, reduced family size) identified within the endogenous-development literature (discussed above) can also be viewed as a component of this pathway.

C. Impact through institutional improvements

A third pathway considers the impact of TE on a wide range of institutions. While capabilities relate to individual capacities and freedoms, institutions relate to collectives, involving both formal organisations and social norms governing behaviour. In addition to the non-market private benefits discussed above, endogenous development theory argues that TE results in a number of non-market *social* benefits, including increasingly democratic institutions, reductions in air pollution, reduced property crime and increased political stability (McMahon 2009). The capability approach also assumes that the expansion of freedoms leads to wider social impacts, such as the strengthening of democracy, social cohesion and good governance.

Institutional growth theory also supports this pathway. According to theorists in this domain, differences in economic growth between countries are largely the result of ‘differences in institutions’ (Acemoglu et al. 2005, p 388). North (1990) argues that institutions directly influence incentives—which, in turn, determine investment in physical and human capital—by ensuring the enforcement of broad-based property rights and diminishing rents for power-holders. Institutional growth theory argues that rules are necessary in order for economic growth and development to happen. Weak political and economic institutions hamper growth (Aron 1996, 2000), while strong institutions, particularly political, judicial and trade institutions, tend to have a positive impact (Glaeser et al. 2004, McMahon 2009).

Improved institutions are also likely to contribute to development outcomes beyond economic growth. For example, TE contributes to improvements in healthcare systems, by educating highly skilled doctors and nurses, and in lower levels of education, through teacher training. High-capacity graduates are also necessary for good governance

(Brannelly et al. 2011), which can then lead to improvements in a wide range of developmental policies (Lazin et al. 1988). Related to this pathway is the literature that considers how TE contributes to social justice and democratic participation within society (for example, Bynner and Hammond 2004). Bynner and Egerton (2001) show that graduates of TE have more positive attitudes towards justice, such as greater racial tolerance. A key role of TE has also been posited in relation to the promotion of citizenship (for example, Arthur and Bohlin 2005; Barnett 2007; Englund 2002), global perspectives (Bourn and Shiel 2009; Bourn et al. 2006) and sustainable development (Cotton et al. 2009). Walker et al. (2010) have examined these normative positions through empirical research in South Africa, by investigating the role of universities in forming pro-poor professionals in the areas of social work, law, engineering, public healthcare and theology.

The connections between TE and institutional development also offer insights into an important feedback loop within the TE sub-sector itself. TE is fundamental to the improvement of its own institutional capacity, as it is the graduates of TE who, ultimately, lead TEIs. One of the institutions to be improved, therefore, is TE itself. Government policies affecting TE can also be strengthened through the cultivation of human capital in TEIs. As government policies can substantially affect the quality of TEIs, this feedback loop is critical.

2.1.2 Pathways through research and innovation

In addition to the pathways to impact through teaching, there is a growing body of literature focused on the second pillar of TE: research and innovation.

Endogenous growth theory has been particularly instrumental in defining this pathway. The central assumption underlying endogenous growth theory is the existence of what Romer (1986) refers to as the ‘positive externalities’ associated with new knowledge. The first externality relates to the replication that tends to occur when new technologies are produced. This process leads to a reduction in the cost of producing such technologies over time. Second, new knowledge leads to efficiency through process innovation, which, in turn, leads to profitability, as new knowledge is translated into processes and products with practical value. In addition to the role of highly skilled personnel in the adaptation of technology and innovation to local industries (discussed above), Romer (1990) argues that TE contributes to development through the cultivation of new knowledge—both directly, through investment in research, and indirectly, through the training of qualified researchers. Romer’s model of endogenous growth evolves to explain the growth seen in higher-income countries. As a result, it stresses the advancement of the newest and most complicated technologies. It is, therefore, unclear whether this pathway to impact is fully applicable to low-income contexts. Research is very expensive, as it requires investment in studies that may, ultimately, not produce results. Lower-income countries often do not have the necessary financial resources to fund adequate research programmes or the institutional capacity to reach the research frontier in complex fields.

2.1.3 Pathways through ‘service’

The remaining literature on TE and development considers the pathways to impact that flow through the third pillar of TE: ‘service’. As discussed earlier, the service pillar refers to all of the functions of TE that fall outside of the domains of teaching and research. This pillar goes by a variety of names, including ‘public service’, ‘community engagement’,

‘extension’ and ‘third-stream activities’, each with different associations. Most of the literature considering the third pillar focuses on the role of TE in knowledge dissemination and exchange.

In the 1860s, the U.S. Federal Government endowed a number of ‘land-grant universities’: public institutions that were intended to work directly with local communities to improve capacity in sectors such as agriculture, engineering and business (Kerr 1982). In the 1970s, the land-grant model inspired a ‘developmental university’ model of TE in many LLMICs, in which TEIs were expected to contribute directly to regional development through agricultural extension, research into development issues and the provision of direct services to the community (Yesufu and Association of African Universities 1973). There is also a strong tradition of community engagement of public universities in Latin America stemming from the Córdoba reform of 1918, based on the moral obligation of universities to provide benefits to the disadvantaged segments of society. In recent years, the definition of ‘service’ has expanded to include the dissemination of knowledge to government and industry, and is increasingly associated with income-generation activities, such as the hiring of faculty members as consultants on government initiatives. The pathway linking such knowledge dissemination to development resembles the pathway via research and innovation, in that it assumes that the dissemination of knowledge improves technological transfer in all sectors, thereby improving productivity and efficiency. Some institutions also provide other direct benefits to local communities, such as offering short courses, providing services such as hospitals and ‘lab schools’, and making available the use of facilities and buildings.

The pathway to impact through service is largely informed by conceptualisations of TE as a public good. This is a theoretical argument that is crucial to consider, given the debate over the ratio of public to private benefits that have long dominated the literature on TE in lower-income contexts (discussed in sub-section A, above). In recent years, this debate has intensified, particularly in relation to the introduction of tuition fees in many contexts. Constraints on state budgets, compounded by evidence of high private returns on investment in TE and the belief that publicly funded TE disproportionately benefits the wealthy, have motivated many governments to shift the burden of pay from the state to the individual. However, if TE is understood to be a public good, this position is problematic, as the state must take some responsibility for funding TE, given that individuals will not have sufficient incentive to invest in the public outcomes themselves (Tilak 2008). Some clarity on the notion of ‘public good’ is needed in order to assess the validity and applicability of these competing claims. The economics literature identifies two key components of a public good: first, it is non-excludable; that is, ‘It is difficult, if not impossible, to exclude an individual from enjoying a good’; second, it is non-rivalrous; that is, ‘The consumption of one individual does not detract from that of another’ (Stiglitz 1999, p 308). According to these criteria, different aspects of TE can be seen as private or public in terms of their benefit. Research and knowledge exchange without constraints of commercial licensing, for instance, are clearly public goods. Tertiary-level study, in contrast, cannot be considered entirely non-excludable, as, in most countries, there is a limited number of places available, and substantial private benefits result. At the same time, TE can be viewed as a public good in terms of the education of key professionals, as there is a broad benefit to society in having well-trained doctors, teachers and other skilled professionals. Furthermore, as discussed in earlier sections, TE’s contribution to

the development of civic knowledge, skills and values can benefit everybody in society (Ahier et al. 2003, Boland 2006, McCowan 2012a, McCowan 2012b). Universities can also act as sites for the preservation of a society's intellectual production or cultural heritage, or as a space for critical reflection and challenging injustices (Barnett 1997, Singh 2001). Although some of these arguments relate to the teaching functions of universities, the public-good literature implies a pathway to impact that directly affects society, without necessarily going via individual graduates. In addition to the funding implications of conceptualising TE as a public good, this theoretical understanding has implications for the range of subjects that should be offered within TEIs. Although they are arguably less critical for economic growth, a public good perspective suggests that subjects such as those within the Arts and Humanities should be supported, given the important societal benefits resulting from their study.

2.1.4 Summary

Although each of these individual pathways provides important insights into the process of how TE can affect developmental change, the overarching conceptual framework guiding this review assumes that TE impacts development through the combined effects of the various pathways. This theory of change assumes that the formation of human capital through TE—and the externalities that arise through such formation—lead to endogenous growth and development, offsetting diminishing returns to physical capital and leading to sustained per-capita growth. In some contexts, the contribution of TEIs to research and innovation may contribute to this cycle. At the same time, TE is assumed to contribute to wider non-economic development outcomes through the production of graduates with increased capabilities and through improvements in public and private institutions. The process is also assumed to benefit from an iterative feedback loop, as the combined effect of these impacts raises the productivity of a population and the capacity of institutions, setting the stage for further growth and development. While, to some extent, these are competing theories, the framework suggests that the pathways to impact are complementary, as they emphasise different functions of the university and different valued aspects of development.

2.2 Underlying assumptions

It is important to acknowledge that there are a number of fundamental assumptions underlying this theory of change. As many of these assumptions are unlikely to hold in the contexts of interest for this review, we elected to highlight them from the outset of the review process, so that we could explicitly examine how the available evidence engages with these potential barriers to impact. In this section, we will outline the main assumptions that are likely to affect the pathways to impact outlined in the conceptual framework. Following the logic of the framework diagram, we have organised these assumptions into three categories: assumptions relating to inputs into TE systems; assumptions relating to the operation and functioning of TEIs (and systems); and assumptions relating to the external environment.

2.2.1 Assumptions relating to inputs

First, the framework assumes sufficient access to and quality of primary and secondary education. Growth equations estimated for East Asian countries indicate that high levels of primary and secondary enrolment were necessary in order for increased enrolment in TE to impact growth (McMahon 1998). In contrast, substantial early investment in TE in the Indian context did *not* result in sustained economic growth per capita, likely because of the lack of comparable expansion in basic education, particularly in rural areas. Some of the pathways to impact also assume relatively high TE enrolment rates. In 2010, over 75% of the eligible population in North America and Western Europe were enrolled in TE (UNESCO Institute for Statistics 2013). In contrast, the gross TE enrolment rate in Sub-Saharan Africa for the same year was estimated at only 7% (ibid.). Theorists have argued that there is a critical threshold that must be reached before TE can have a substantial impact on macro-level outcomes. Tilak (2010), for instance, postulates that a 40% enrolment rate is necessary for TE to affect significant change.

The model also assumes equality of access to TE. However, there is an extensive literature identifying substantial inequalities of access in LLMICs. For instance, studies have highlighted inequalities in access relating to gender and to race/ethnicity (see, for example, Morley and Lugg 2009; Naidoo 1998; Sifuna 2006). The recent emphasis on ‘cost-sharing’ also has important access implications, as, in many contexts, TE is only accessible to those who can afford to pay tuition fees.

2.2.2 Assumptions relating to the functioning of TE

The pathways to impact all assume that TE is of sufficient quality. Teaching, in particular, must be of sufficient quality in order to yield the required human capital to affect development outcomes. For instance, many of the pathways require that graduates finish TE with sufficient “high skills” to allow them to interact with existing knowledge and adapt innovations to their own industries and contexts (Brown et al. 2001). High-quality research is also assumed by many of the pathways, both in terms of the production of new knowledge and the ability of faculty members to share such knowledge with their students. However, it is clear that the history of TE in LLMICs has had a profound impact on the quality of both teaching and research. Reductions in external aid to TE (inspired by the ROR analyses of the 1980s), combined with the effects of structural-adjustment policies on public spending, resulted in a drastic lack of funding for TE in lower-income contexts throughout the 1990s. As a result, TEIs were unable to pay adequate wages or hire a sufficient number of staff to cope with rising student enrolment. Many of the most qualified faculty members emigrated to universities in Europe and North America during this period (Ajayi et al. 1996, Herrera 2006, Schwartzman 2008). As a result of this ‘brain drain’, many institutions have retained very few sufficiently qualified academic staff. Infrastructure has also deteriorated, leaving many institutions with limited capacity to conduct or access research. The negative impact on academic quality of these circumstances has been further compounded by inefficient and, in some instances, corrupt governance within TEIs (World Bank 2002). The existence of supportive institutional governance is, therefore, another indirect assumption of the framework.

The model also assumes that graduates of TE will develop skills in a wide range of academic disciplines. For endogenous development to occur, graduates must be able to

improve a wide range of institutions, including local government, the judiciary, the healthcare system, the education system and civil society. This requires education in the social sciences, biological sciences, health sciences, the law and so on.

In addition to equality of access, the conceptual framework assumes equality of TE experiences. However, there is evidence that this assumption also does not hold in many LLMICs. For example, Morley and Lugg (2009) have analysed the experiences of female students at universities in Ghana and Tanzania, identifying a number of hidden barriers and obstacles facing them, such as strong social pressure to marry and bear children, gender stereotypes relating to particular disciplinary areas and sexual harassment.

Finally, the model implicitly assumes access to postgraduate programmes as a necessary component of the feedback loop. The ongoing potential of TE to contribute to development is only possible if TEIs have a sufficient supply of trained faculty to enable them to continue to operate effectively.

2.2.3 Assumptions relating to the external environment

The pathways to impact also assume that TEIs and their surrounding environments will allow academic freedom. TE cannot function as a public space for critique, for example, without the freedom to express contradictory or unpopular ideas. The quality of teaching and research can also be affected by a lack of academic freedom within an institution or a society. Despite the importance of this assumption, there is substantial literature regarding the lack of academic freedom in many LLMICs (for example, Ajayi et al. 1996, Coleman 1986, Mkandawire 2005, Herrera 2006).

Another important assumption is that graduates will apply their skills to local industries and institutions, rather than emigrate. Brain drain of graduates, as well as of faculty members, has been a serious problem for LLMICs, as the impact of TE has been reduced due to the departure of highly skilled human capital from the local context.

The model also assumes that there is a supportive 'enabling environment' for TE (Palmer et al. 2007). This concept encompasses all aspects of the local environment that affect the ability of graduates to capitalise on their education. The existence of employment opportunities and support for entrepreneurship are examples of a positive enabling environment. This assumption is also relevant for the pathways to impact through research, innovation and service, as factors such as the level of interaction between TE and local industry can have a profound effect on the ability of TE to influence development.

3. Methodology

This review was conducted as a ‘rigorous’ review of evidence, meaning that the study methodology followed the principles of systematic reviewing, while allowing for the incorporation of evidence that might not pass the stringent standards of a full systematic review. The core team for the review comprised two principal investigators and one research officer. This team benefited from the assistance of four additional research officers and one information scientist during the searching, screening and coding phases of the review. A nine-member expert panel also provided input at key stages of the project.

The review was organised in five distinct phases:

1. Planning: Elaboration of the conceptual framework and articulation of the search strategy
2. Searching: Identification of relevant literature
3. Screening and coding: Investigation of the scope and relevance of identified literature, resulting in a reduced list of studies, and simultaneous descriptive coding of the included studies
4. Quality appraisal: Analysis of the quality of all included studies, resulting in a further-reduced list of studies for synthesis
5. Synthesis: Analysis of the evidence from the included studies

This section presents an overview of the study methodology. Further detail is available in Appendix 1.

3.1 Searching for evidence

Potentially relevant literature was identified in two ways:

1. By identifying existing systematic reviews in related areas that could yield relevant references for inclusion in the review
2. By conducting targeted searches in a wide range of bibliographic databases and websites that were likely to contain information relevant to the review

In total, 12,213 titles were identified as potentially relevant to the review and imported into EPPI-Reviewer, a specialist software package designed to assist with information management in systematic reviews (Brunton and Thomas 2012). A duplicate check was then conducted within EPPI-Reviewer, which removed 338 titles as duplicates.

Given the very large volume of potentially relevant literature and the need to maintain a tight focus in the study, the decision was made to alter the scope of the review by focusing exclusively on low-income and lower-middle-income countries, excluding upper-middle-income countries. We also elected to exclude LLMICs located in Europe or the former Soviet Union, given the distinct histories and TE contexts of countries in these regions. Using the World Bank classification of countries, we ran an initial automated search within EPPI-Reviewer to identify titles and/or abstracts that explicitly mentioned the names of LLMICs; those studies without such references were excluded from the review. The remaining **6,677 titles** were retained for consideration during the screening and coding phase of the study.

3.2 Screening and coding

Studies were then screened in two stages, first for title and abstract and then for full text. During both stages, potential sources were reviewed and assessed against the study's inclusion/exclusion criteria. In order to proceed to the next stage in the process, each study had to meet all of the following criteria:

- Date: Published since 1990
- Language: Written in English⁴
- Geographic context: Focused on at least one low-income or lower-middle-income country (not including countries in Europe or the former Soviet Union)⁵
- Sector context: Focused on some aspect of TE (as defined in Section 1.2). Studies considering 'post-primary' education, in which the relative impact of secondary versus tertiary education cannot be disaggregated, were excluded from the review
- Type of literature: Published source likely to include some element of peer review or adherence to professional standards of research (such as journal articles, books, conference papers, or institutional grey literature). Unpublished sources, such as theses/dissertations and meeting minutes, were excluded from the review, as were newspaper articles.
- Type of study: Empirical research (using either quantitative or qualitative methods) examining at least one of the various pathways to impact included in the conceptual framework. Purely descriptive or normative sources, such as statements of policy, were excluded from the review. Empirical studies had to attempt to investigate *impact on development* in order to be included. Studies focusing exclusively on inputs (such as financing arrangements, institutional governance structures, faculty numbers and/or qualifications, or TE policies) or on experiences within TEIs were not included, unless they analysed the effect of such inputs or experiences on development outcomes.

During the screening stages, it quickly became apparent that there were studies on the list for potential inclusion that did not provide any evidence in reference to the central research question, but that might offer useful information to support the final analysis. First, there were a significant number of studies that seemed empirically to investigate one of the underlying assumptions discussed in the previous section. As we knew that these assumptions were likely to have an influence on the potential impact of TE in LLMICs, these studies seemed important, although they did not offer any specific evidence of impact. Second, there were a number of studies analysing the impact of particular TE interventions in LLMICs. Although these studies did not consider the impact of such interventions on development outcomes, they did attempt to investigate empirically the effectiveness of the interventions relative to more proximate outcomes, such as improved performance of students. Rather than exclude all of these titles from the review, we decided to code them as 'assumptions' and 'interventions' titles, and these studies (620 in total) were set aside for separate consideration at the end of the review process.

At the end of the screening process, **147 studies** were retained for quality appraisal.

⁴ Studies written in other languages were not included on account of time and resource constraints. French- or Spanish-language studies were initially included in the database search and title and abstract screening, but were subsequently excluded.

⁵ A full list of included and excluded countries can be found in Appendix D.

3.3 Quality appraisal

Included studies were then screened for robustness of evidence and methodological rigour, using the standards set out by the DFID 'How to note' on 'Assessing the strength of evidence' (DFID 2013). The guidelines for the REPOrting of primary empirical research Studies in Education (the REPOSE Guidelines) also informed the quality standards used when assessing the remaining studies (Newman and Elbourne 2005).

Those studies found to meet the quality standards were coded on a number of additional descriptive variables (for example, data-collection method and data-analysis method), in order to capture the diversity of methods and levels of robustness of the resulting evidence. In total, **99 studies** were retained for synthesis. A list of the 99 included studies has been included as Appendix 6.

3.4 Data synthesis

Meta-synthesis was then used to examine the degree to which the body of evidence reflects the various pathways to impact outlined in the conceptual framework. The analytical approach was based on the principles of framework synthesis (Thomas et al. 2012), a method that allows for the identification of key issues and recurrent themes among studies. Studies were initially grouped thematically. The review team then summarised the literature within each thematic group, outlining the geographic context, study design, major findings and level of robustness of each individual study. The summarised findings were then compared and contrasted, and overall conclusions were drawn within each group. The strength of each body of evidence was also assessed at this stage. The overall findings were then mapped onto the existing conceptual framework, allowing the identification of areas of non-applicability and the refinement of our initial understanding of how TE impacts development in LLMICs.

4. Overview of included literature

In preparation for synthesis, the 147 titles identified as being relevant to the scope of the review question were coded on a number of dimensions, in order to map the conceptual range of available literature in this domain. Coding focused on study context, research design and links to the conceptual framework underlying the review. The 99 titles included in the final synthesis were also coded in order to capture the methods used for data collection and analysis, and the generalisability of the study results. This section presents the results of this initial mapping exercise.

4.1 Geographic context

Of the 147 included titles, the majority focus on Sub-Saharan Africa or South/South-East Asia—mainly on account of the ‘low- or lower-middle-income’ country classification used. A detailed breakdown of titles by region is presented in Table 4.1, below⁶.

Table 4.1: Breakdown of included studies by region

Regional Focus	Number of Studies
Sub-Saharan Africa	69
South and South-East Asia	47
Latin America and the Caribbean	4
Pacific Islands	4
North Africa and the Middle East	4
No specific region (study considers all or most lower-income contexts)	22

Within these regional contexts, a handful of countries are particularly well represented in the sample. Of the Asian nations, India and Pakistan are the most represented, while Nigeria, Kenya, Tanzania and Ghana are the most common African contexts. The focus on English-language studies is likely to have biased the sample slightly towards Anglophone contexts. However, there was a sufficient diversity in national contexts to allow for a broad consideration of TE impact. The country breakdown is presented in Table 4.2.

Table 4.2: Breakdown of included studies by country

Country Focus	Number of Studies
Nigeria	16
India	15
Pakistan	12
Kenya	12
Tanzania	10
Ghana	8
Ivory Coast; Uganda; Vietnam	5 each
Indonesia; Malawi; Rwanda	4 each
Egypt; Fiji; Sri Lanka	3 each
Bangladesh; Eritrea; Ethiopia; Nepal; Philippines; Zambia; Zimbabwe	2 each
Cameroon; East Timor; Guatemala; Iraq; Madagascar; Mozambique; Niger; Papua New Guinea; Paraguay; Senegal; Sudan; Syria; Yemen	1 each
Regional or international study (no specific country focus)	36

⁶ The counts included in this summary do not always add up to 147 (or, later in the section, 99), as studies may have received multiple codes for the same category.

4.2 Type of study

In addition to identifying the geographic context, studies were classified by overarching study design, setting and study population.

The vast majority of studies are quantitative observational studies (108 of the 147). Fourteen studies are qualitative, and 25 are mixed-method. None of the studies takes an experimental or quasi-experimental approach. The vast majority of studies are, therefore, population-level studies (115). Some studies focus explicitly on graduates within a particular context (29), while a handful focus on faculty members and/or administrators (9).

As for the study setting, most studies focus on a particular national context (73). Nineteen consider the impact of TE on a particular region within a country, and 21 focus explicitly on one or more institutions within a national context. Nineteen studies look at data from a broader region (for example, South-East Asia), and 23 examine international data, investigating how lower-income contexts fit into global trends.

4.3 Conceptual orientation

Studies were also mapped against the current study's conceptual framework.

Studies were first classified in terms of the type of TE under consideration. Most studies consider the impact of all kinds of TE in a given context (116 out of 147). Twelve studies focus on research universities, 11 consider technical institutions, and four focus on medical schools. Six studies focus exclusively on public TE. One study looks explicitly at women's colleges. Sixty-four of the studies compare the impact of TE to that of other levels of education (that is, secondary and primary education). As expected, the vast majority of studies focus on the teaching pillar of TE (121 out of 147). One considers only the research pillar, and two consider only the service pillar. Twenty-three studies look at a combination of functions in their analysis.

It was anticipated that the majority of studies would focus exclusively on economic development. However, the studies consider a wide range of development outcomes. In addition to economic growth, income inequality and poverty reduction, a number of studies consider the impact of TE on gender equality. There are also a number of studies considering impacts on health, governance, institutions and population growth. Most studies consider these outcomes at national level (109 out of 147), although 15 consider regional impacts and 30 consider local impacts within a national context.

The breakdown of studies by development outcome is presented in Table 4.3 below.

Table 4.3: Breakdown of included studies by development outcome

Development outcome	Number of studies
Economic growth	63
Income equality	42
Gender equality	34
Institutions	26
Health	24
Poverty reduction	22
Governance	17
Improvement of lower levels of education and/or literacy	9
Population growth	7
Environment	6

The results of this summary exposed one limitation of the search strategy. Of the 147 studies, only nine considered the impact of TE on improvements in lower levels of education. It is known that there is extensive literature on this subject, for example on the influence of teacher education on the quality of teaching in schools, but it is clear that this was not captured through our search strategy. This is likely to be because we did not include ‘primary education’ and ‘secondary education’ as search terms, so as to exclude studies focused on the impact of lower levels of education on development. Although this was a pragmatic strategy in light of the large volume of literature identified, it may have limited our ability to assess the evidence of the impact of TE on lower levels of education.

In terms of the inputs included in the conceptual framework, a number of studies consider how the number of years of enrolment (41 studies) and/or how the proportion of eligible students enrolled in TE (20 studies) may impact development outcomes. Thirty-one studies explicitly consider how the composition of the student population (that is, the proportion of male and female students, the proportion of low-income students, etc.) affects development. Thirty-six studies consider the role of funding modes on development outcomes. Many of these studies are ROR analyses. Some studies look at the impact of policy (24 studies), institutional governance (six studies) and characteristics of the faculty population (six studies) on development outcomes.

As expected, given that most studies consider only the teaching pillar of TE, the vast majority of studies assume that graduates are the primary output of TE (133 of the 147 studies). Thirteen studies consider research outputs, while 14 consider the services provided by TEIs.

TE outcomes are more broadly distributed within the range of included titles. Unsurprisingly, many of the studies (81) focus on earnings as a pathway to development (81 studies). However, many studies also consider the role of externalities (19 studies), increased productivity (25 studies), technology transfer (20 studies), improved capabilities (39 studies) and improved institutions (24 studies).

Although quite a few studies (47) did not make their theoretical orientation explicit, a large proportion used HCT as their central paradigm (69 studies). Eighteen of the studies take an endogenous growth approach. Other theoretical paradigms are much less frequent

in the sample (five allude to endogenous development, four to capability theory, four to conceptualisations of TE as a public good, and two to institutional growth theory). Nineteen reference another theoretical lens not included in the conceptual framework.

4.4 Research objectives and methodology

Of the 99 studies included in the final synthesis, most rely on existing datasets, such as results from national surveys or institutional reports (76 studies). Thirty-three studies use new datasets collected as an explicit component of the study methodology.

The studies rely on a range of methods, reflecting the diversity of study designs included in the scope of the review. As most of the studies are quantitative in nature, it is unsurprising that the most frequently used data-collection methods were household surveys or other types of questionnaires (75 out of 99 studies). Seventeen studies relied on institutional statistical records, while 15 used existing datasets owned by international organisations, such as the World Bank. Interviews (both individual and group) were used in 14 of the 99 studies. One study used observational methods, while five studies analysed policy and/or institutional documents.

As many of the studies are economic in nature, econometric modelling is the most frequent analytical technique, used in 64 of the studies. Other kinds of statistical analyses, including the use of descriptive statistics, are used in 39 of the studies. Five of the studies rely on case-study analysis, while other studies use other qualitative methods, such as narrative analysis (four studies), document and/or policy analysis (six studies), and thematic analysis (three studies).

Findings from the majority of the included studies must be viewed as context-specific, due to the particular study design used and/or research questions posed (76 out of 99 studies). Twenty-three of the studies present sufficiently robust evidence across contexts to be considered more broadly generalisable.

5. Synthesis of available evidence

Using the principles of framework synthesis, the evidence from the 99 studies was analysed thematically, following the logic of the current study's overarching framework. In preparation for synthesis, the studies were grouped by their association with the various potential outcomes of TE, as outlined in our conceptual framework: earnings and externalities, productivity, technological transfer, capabilities and institutions. When articulating the conceptual framework, we grouped the pathways to impact by pillar of TE, as we found this to be the most coherent way to represent the myriad ways in which TE might impact development. However, for the purposes of synthesis, we determined that it would be more useful to consider the evidence in terms of the outcomes of TE, as it is these that are most explicitly relayed in the findings of the studies. Furthermore, it became clear during the mapping exercise that the majority of studies in our sample relate to the teaching function of TE, so grouping by pillar would not have been a very useful strategy for synthesis. Table 5.1, below, outlines the overall breakdown of the included studies. As some of the studies included evidence relating to more than one pathway, certain studies appear in more than one part of the synthesis.

Table 5.1: Studies included in final synthesis

Outcome Grouping	Number of Studies
Earnings and externalities	66
Productivity of graduates	13
Technological transfer	8
Capabilities	24
Institutions	13

5.1 Evidence of impact through earnings and externalities

Key finding:

The studies show that TE has a strong impact on the earnings of graduates. There is evidence that TE has a stronger impact on growth than previously assumed. However, there are some inconsistencies in the results, largely due to methodological differences between studies. The impact of TE on income equality is difficult to isolate and appears to vary significantly depending on context.

In total, 66 studies were identified as providing evidence around the earnings function of higher education. Many of these studies use panel data, with the most extensive ones covering multiple countries. The evidence in these studies tends not to be disaggregated by country, as the number of observations would be too small to demonstrate significance. In the aggregate, these studies highlight the complexity of the relationship between earnings and growth, with evidence indicating that earnings of TE graduates are high, but distorted in LLMICs. The 66 studies considering the earnings pathway can be divided into two groups: those considering how TE affects earnings, and those considering the macro-level relationship between TE and economic growth.

5.1.1 Impact on earnings

Of the 66 earnings titles, 48 consider the relationship between TE and earnings. The majority of these studies investigate this relationship at national level, although seven are regional and six analyse returns at global level. Most of the studies consider African contexts (six at regional and 17 at national level). The national studies focus on Kenya (four studies), Cote d'Ivoire (four studies), Tanzania (two studies), Nigeria (two studies), Ghana (two studies), Uganda (one study), Rwanda (one study) and Cameroon (one study). Very few studies were identified of West or Central African contexts, likely due to our exclusive consideration of studies written in English. Fourteen of the national studies examine Asian contexts, including India (six studies), Pakistan (three studies), Vietnam (two studies), Indonesia (two studies) and the Philippines (one study). The remaining non-global studies consider the impact on individual earnings in Egypt, Vietnam and Paraguay, with one additional regional study focused on the Pacific Islands. All but one are quantitative studies (the exception being mixed-method).

The earnings function is considered to be the most studied relationship between education and development in empirical economics (Teal 2011). Credited to Becker (1962), it is mainly associated with Mincer (1974) and focuses on how individual earnings and investment in human capital (through education) are related. Traditionally, this relationship was assumed to be linear, but many of the studies included in this review suggest that it is more likely to be non-linear, given that TE is not isolated from preparation that takes place in the earlier stages of education at primary and secondary levels (see Teal 2011, Gyimah-Brempong et al. 2006). In Teal's words, 'The value of education in the early part of the education cycle is in part the value of being able to continue to the next stage,' (2011, p iii62-63).

One area of substantial debate within the literature is the question of whether the relationship between education and earnings is *concave* (meaning that the marginal returns to education are higher for individuals with lower levels of education) or *convex* (meaning that the returns are lowest for those with the least education). According to the influential body of evidence presented by Psacharopoulos (1994; et al. 1994; with Patrinos 2004), the earnings function is concave in lower-income countries, meaning that returns are higher for lower levels of education. However, more recent evidence from Sub-Saharan Africa, presented by Teal (2011) and Schultz (2004), indicates higher returns for higher levels of education in Africa. Their analyses suggest that, unless those with the least education proceed to higher levels of education, primary education is likely to have little impact on income.

Most of the reviewed literature indicates that there are high private returns on investment in TE in LLMIC contexts. Using household-survey data collected between 1985 and 1998, Schultz (2004) finds higher private wage returns for higher education than for primary education in Ghana, Cote d'Ivoire and Kenya. Similar results were identified in Pakistan (Abbas and Foreman-Peck 2008, Afzal 2011, Asghar and Zahra 2012), India (Azam 2010, 2012, Kingdon and Unni 2001), the Pacific Islands (Born et al. 2008), Vietnam (Doan and Stevens 2011; Glewwe et al. 2002); the Philippines (Schady 2003); and a number of other countries in Sub-Saharan Africa (Al-Samarrai and Bennell 2007, Amaghionyeodiwe and Osinubi 2007, Diagne and Diene 2011, Fonkeng and Ntembe 2009, Grootaert 1990, Gyimah-Brempong et al. 2006, Kahyarara and Teal 2008, Kristensen and Verner 2008, Lassibille and

Tan 2005; Manda et al. 2002, Rolleston and Oketch 2008, Obwana and Ssewanyana 2007, Rugar et al. 2010, Soderbom et al. 2006, Teal 2011, Uwaifo Oyelere 2011). In their global synthesis of ROR studies, Fasih et al. (2012) also detect a similar trend.

In fact, a number of these studies (for example, Duraisamy 2000, Fasih et al. 2012, Glewwe et al. 2002) indicate that ROR on higher education has trended upward in lower-income countries in recent years. In many contexts, this is likely to be a result of increased access to primary and secondary education, as such expansion leads to a surplus of individuals with lower levels of education in the labour market. The comparative scarcity of those with higher education then allows them to earn a premium in wages. This trend raises questions around how these identified relationships may change, following the realisation of universal basic education, as this will clearly result in increased demand for—and increasingly limited supply of—TE provision.

Some of the included studies consider the link between TE and earnings within particular sectors of the economy. Teal (2011) notes that the relationship between earnings and education is complicated by the fact that individuals with identical levels of education can earn a wide range of incomes (p iii62). This concept is further elaborated through other studies, which consider differential returns to TE for males and females, for employees of the formal and informal sector, for urban and rural workers, and for paid-wage workers versus self-employed individuals (Agesa et al. 2013, Al-Samarrai and Reilly 2008, Deolalika 1993, Duraisamy 2000, Dutta 2006, El-Hamidi 2006, Fasih et al. 2012, Frisancho Robles and Krishna 2012, Grootaert et al. 1995, Kimenyi et al. 2006, Manda et al. 2002, Mook et al. 2003, Vijverberg 1993).

A handful of these studies also consider how returns to education differ along the earnings distribution. These studies test the longstanding assumption that investment in TE disproportionately benefits the wealthy by directing public funds towards a sub-sector that tends to be heavily populated with individuals from high-income backgrounds. This argument is an important one within the literature, as it has been used, alongside the concavity argument, as a justification for prioritising investment in lower levels of education. Some of the studies included in this review continue to advocate this position. Keller (2006), for example, argues that many lower-income countries spend too much on TE, given low ROR on investment in higher education and continuing high levels of illiteracy in many lower-income contexts. Keller (ibid.) also suggests that subsidisation of higher education, through full scholarships and limited resource recovery from wealthy parents, continues to make TE a regressive investment in many developing contexts, noting that this can be exacerbated by corruption in some countries. Asghar and Zahra (2012) and the World Bank (2011) agree that investment in lower levels of education is more of a pro-poor policy than investment in TE (in reference to the Pakistani and Malawian contexts, respectively).

Other studies suggest that the perceived relationship between investment in education and income inequality is likely to be distorted in lower-income countries, because of frequent subsidisation of TE through merit-based scholarships, limited enrolment in basic levels of education and high levels of employment in the public sector (Keller 2006, McMahon 1999, Teal 2011).

Although income equality was discussed in some studies, we could identify very few studies that explicitly investigated the relationship between TE and poverty reduction. Fasih et al. (2012) analyse the relationship in a number of contexts and determine that TE has an equalising effect in some contexts and a dis-equalising effect in others. Their central conclusion is that primary education is insufficient for poverty reduction, but that the impact of higher education is likely to differ, depending on the stage of an economy's development. Akita and Miyata (2008) found evidence of the impact of TE on increasing income inequality in Indonesia, largely due to rising inequality in the earnings of urban residents, while Nsawah-Nuamah et al. (2012) could find little relationship between TE and poverty reduction in Ghana. Tilak (2010) found TE to have a positive impact on poverty reduction in his global analysis of TE effects, but he could not identify a similar relationship within the Asian context (2003).

Overall, the studies in this group suggest that TE has a strong impact on the earnings of graduates in most LLMIC contexts, but that this relationship is not directly linear, with some individuals benefiting from higher returns than others. The impact of TE on income equality is difficult to isolate and appears to vary significantly depending on context. The evidence outlined in this section is generally less robust at macro than at micro level, making it difficult to identify causal relationships.

5.1.2 Impact on economic growth

Twenty-five studies in this grouping consider the relationship between TE and economic growth. In contrast to the earnings literature, many of these studies are global (eight studies) or regional (five studies) in scope. An additional 12 studies consider these macro-level returns at national level.

As with the earnings literature, most of the regional and national studies focus on Sub-Saharan Africa (four regional and four national) or South and South-East Asia (one regional and six national). The national studies included in the review consider the following national contexts: Pakistan (two studies), India, Nepal, Sri Lanka, the Philippines, Uganda, Cameroon, Nigeria, Ghana, Fiji and Guatemala. All of these studies are quantitative in nature. Unlike the earnings titles, which all relate exclusively to the teaching 'pillar', four of these titles relate to a combination of TE functions.

The evidence in this group of studies is inconsistent, with some studies arguing that TE has a strong impact on economic growth and others claiming that lower levels have more of an impact. The regressions published by Keller (2006) and McMahon (1999, 2003) show that primary education and secondary education yield greater economic benefits than TE in lower-income contexts, especially in countries where the basic-education enrolment rates remain low. Keller's (2006) analysis is one of the most extensive studies included in the review. In her study, she discusses both the link between TE and higher earnings and the indirect spill-over external social benefits of TE (p 18). Keller asserts that, 'Higher education is likely needed to invent technology' (p 18), but finds that it does not, in itself, form the bedrock for economic growth through earnings. In her growth equations, Keller (2006, pp 24, 27) finds '[TE] enrolment rates are less significant [for economic growth] when only [less-developed countries] are considered compared to the global sample and lose their significance once fertility is added.' Loening (2005) observes a similar effect in the Guatemalan context, where primary and secondary levels of education appear to have

a more significant impact on growth than TE. Ndiyo (2007) also finds no significant relationship between the number of university graduates and economic growth in Nigeria. The use of Granger causality analysis led Self and Grabowski (2004) to conclude that only primary and secondary education have a causal impact on growth in the Indian context, although they conclude that female education at all levels has a significant causal impact. Wolff and Gittleman (1993) found that primary and secondary enrolment rates had a significant impact on growth in less-developed countries, but that higher education enrolment rates did not (data were from 1960 to 1985). In their global study of aid to education, Asiedu and Nandwa (2007) conclude that aid to post-primary education does not lead to growth in low-income countries, while aid to TE in middle-income countries does help to stimulate growth.

Other studies suggest the opposite conclusion. Using panel data from a sample of African countries, Gyimah-Brempong et al. (2006) offer a comprehensive estimation of the effects of higher education on the growth of per-capita income in African countries between 1960 and 2000. Their study finds that all levels of education have a statistically significant impact on the growth of per-capita income, all things being equal. However, they find this effect to be particularly strong for higher education, with a 1% increase in average years of higher education increasing the growth rate in per-capita income by approximately 0.09 percentage points per year (p 511). They acknowledge overestimation in their results, but their overall conclusion suggests that expansion of higher education in African countries will have a substantial effect on increasing the growth rate of per-capita income. Using panel data from 93 countries, Agiomirgianakis et al. (2002) conclude that education has a significant long-run effect on growth and, importantly, that this effect intensifies with increasing levels of education. A number of national studies also support the conclusion that TE leads to economic growth (Fonkeng and Ntembe 2009, Ganegodage and Rambaldi 2011, Ramos et al. 2012, Stengos and Aurangzeb 2008). Tilak has also observed a similar effect, both in global analysis (2010) and in regional analysis of the Asian context (2003).

Bloom et al. (2006) also argue that TE leads to economic growth, but they suggest that this occurs largely through externalities. In their study, they demonstrate that TE stimulates increased savings and investment, which in turn supports an increase in the amount of income tax collected (a factor that stimulates economic growth). Evidence of impact via taxation has also been identified in Fiji (Heaton 1999) and Uganda (Obwana and Ssewanyana 2007).

One study (Nyarko 2011) explicitly takes the brain drain into consideration when investigating the relationship between TE and growth in Ghana. Nyarko's analysis suggests that the remittances sent back to Ghana by Ghanaians who have pursued TE abroad positively impact economic growth. This finding seems to contradict the assumption that brain drain has a negative impact on economic development in LLMICs.

Although he acknowledges that TE has not led directly to economic growth in most African countries, Teal (2011) notes that, between 1950 and 2010, in the 32 Sub-Saharan countries included in his study, the percentage of individuals with TE has only risen from 0.1% to 0.9% of the total population aged 15 years and above (p iii54). Although a large change, this is a much smaller increase than was observed during the same period in either the totality of developing countries (where the percentage with TE has risen from 0.5% to

5.1%) or globally (where the percentage with TE has risen from 1.1% to 6.7%) (data from Barro and Lee 2010, quoted in Teal 2011, p iii54). The total percentage of individuals with TE remains very low in most African countries, and Teal suggests that this may be limiting Africa's ability to initiate the kind of growth that has been seen elsewhere. This low level of TE participation also makes it harder to analyse fully impact on growth, as the levels of participation may be too low to lead to clear growth accounting. This same argument has been made within the Pakistani context (Afzal et al. 2011). In their analysis of the impact of capital flows on growth, Kyaw and Macdonald (2009) conclude that low TE enrolment is a likely reason for the limited impact of capital flows on growth in low-income contexts. Their analysis highlights the important role that TE appears to play in increasing the capacity of an economy to absorb foreign direct investment (FDI) and other incoming capital flows.

Teal (2011) also raises the critical point that the causal relationship may work both ways, meaning that correlations between economic growth and TE enrolment may actually indicate a reverse causal pathway (with growth leading to increased enrolment). Wolff and Gittleman (1993) reached the same conclusion in their earlier analysis of global trends, and Dahal (2010) recently found evidence of this reverse causality within the Nepali context. Such a possibility implies that, if steps are not taken to allow for a two-way flow of causation during analysis, there may be a simultaneous bias in the coefficients, meaning that the effects of higher education on growth can be overstated. Keller (2006), Tilak (2003; 2010) and McMahon (1999; 2003) build an explicit time lag into their growth equations, which minimises the potential for such bias to affect education coefficients.

Although the specific contribution of TE to economic growth in LLMICs remains unclear, the evidence summarised in this section suggests that TE has a stronger impact on growth than was previously assumed. However, there are some inconsistencies in results, due to methodological differences between studies and barriers to impact in some contexts.

5.2 Evidence of impact through increased productivity

Key finding:

There is some evidence to suggest that TE has a positive impact on productivity in the workplace, but the relationship is not conclusive, given the lack of available data and the likely barriers to impact in many LLMICs.

Within the economics literature, earnings are often used as a proxy for the level of human capital within a labour force. The assumption is that more productive employees will earn more than less productive employees. As many of the studies outlined in the previous section rest on this underlying assumption, they can be considered studies of how TE impacts development by increasing the productivity of its workforce. However, only a handful of these studies (11) explicitly discuss productivity as an outcome of TE, independent of earnings. The findings from these studies, plus two others not included in the earnings section, are examined in this section.

As in previous sections, most of the productivity studies focus on African and Asian contexts. Three of the studies are global in nature, while six are regional (four within

Africa, one in Asia and one in Latin America). The remaining four studies discuss the following national contexts: Pakistan, Ghana, Nigeria and Guatemala.

Some of the studies in this grouping indicate that TE does make a moderate contribution to economic growth via the productivity pathway. Bloom et al. (2006) provide one of the most extensive analyses of the productivity link between higher education and development in LLMIC contexts. One of their main findings is that TE raises the rate of technological convergence (the process whereby technologies merge to perform similar tasks and nations come closer in technological integration). Teal (2011) and Diagne and Diene (2011) also find that improved productivity, as a result of enrolment in TE, contributes to innovation and technical progress. One study in this grouping (Larbi-Apau and Sarpong 2010) considers the impact of TE on the overall productivity of one specific industry—the poultry industry—in Ghana. Their results suggest that the proportion of managers with TE is a significant factor in the overall productivity of the industry. TE has also been found to raise productivity within the public sector in several countries in Sub-Saharan Africa (Teal 2011) and in Pakistan (Abbas and Foreman-Peck 2008).

Other studies suggest that the lack of access to up-to-date knowledge within TEIs is limiting TE's impact on productivity in some LLMIC contexts (for example, de Ferranti et al. 2003, re: Latin America; Di Gropello et al. 2012, re: Asia; Loening, 2005, re: Guatemala). Other studies postulate that low quality of TE provision prevents the sub-sector from having a positive impact on productivity (Wolff and Gittleman 1993) and that barriers within the enabling environment, such as a lack of capital and support for entrepreneurial development, may further limit graduate productivity in LLMICs (Al-Samarrai and Bennell 2007).

A number of studies discussed in Section 5.1 suggest that TE makes a greater contribution to growth than was previously believed. Much of this argument relies on claims that productivity, particularly within the non-public sector, has not yet been adequately captured or assessed. The body of evidence described in this section does not allow for a complete investigation of this claim, given the small number of studies explicitly considering the impact of TE on productivity, independent of earnings. Additional research in this area is, therefore, needed in order to reach any definitive conclusions on the contribution of TE to productivity in diverse employment sectors within LLMICs.

5.3 Evidence of impact through technological transfer

Key finding:

In the aggregate, there is very little macro-level evidence that TE contributes to development in LLMICs through research and innovation. However, there is some evidence to suggest that the proportion of workers with higher education within a given context may increase the likelihood of technological uptake and adaptation. There is also limited evidence that research outputs may impact development at local level by increasing the productivity and efficiency of SMEs.

In addition to the potential impact of TE on individual productivity, the theoretical literature suggests that TE contributes to development by increasing the productivity and efficiency of industries and other institutions through innovation and technological transfer. As anticipated, very few studies were identified that empirically investigate the

process of technological transfer in LLMICs. In total, 20 individual studies were identified that pertained to technological transfer. However, 12 of these were excluded during the quality-appraisal phase, leaving only eight studies for synthesis.

The eight studies represent a range of geographic contexts, as three focus on Sub-Saharan Africa (all national studies), two on Latin America (one regional and one national study), and two on South-East Asia (one regional and one national study). The remaining study is global in nature. The studies also represent a range of methods. Five studies rely on primary research in individual country contexts. Of these five, three are qualitative studies, one is a quantitative analysis, and one is a mixed-method study. The remaining three studies rely on secondary datasets and are largely quantitative in nature (although one includes some documentary analysis of policy literature). In contrast to the literature described in the previous two sections, there is a wider diversity in the ‘pillars’ of TE discussed within this group of literature: of the eight titles, only three relate exclusively to the teaching pillar, while five discuss a combination of TE outputs.

Despite the wide variety of contexts and research methods included in this grouping, the results across the studies are largely consistent. Both of the regional studies (de Ferranti et al. 2003; di Gropello et al. 2012) identify a correlation between national GDP and expenditure on research and development (R&D), suggesting that low levels of investment in R&D may be associated with low levels of economic growth. The same studies also identify a low output of patents and research citations (two traditional measures of research productivity) within LLMICs. In the Asian context, di Gropello et al. (2012) found a positive relationship at company level between technological innovation and the proportion of workers with higher education. The same study identified a positive relationship between FDI, innovation and the proportion of TE graduates at company level. In his analysis of international data, McMahon (1999) does not find new knowledge, generated through investment in R&D, to be a positive or significant factor in developing countries, independent of the proportion of highly educated workers in the workforce.

Evidence from three of the individual-country studies generally supports the results from the global and regional analyses. Within the Vietnamese context, Ca (2006) finds little evidence of extensive transfer of research and/or innovation between universities and firms. In fact, when disaggregated by type of industry, Ca (ibid.) determines that the only firms in Vietnam demonstrating high levels of technological uptake are large, typically state-run, corporations, rather than SMEs. Such corporations were more likely to work with foreign industries to obtain new knowledge and innovations, rather than relying on research outputs from local universities. Loening (2005) also finds little evidence of a relationship between TE and technological innovation in Guatemala. In Ethiopia, Gondo and Dafuleya (2010) found that TVET colleges had very little interaction with informal industries, despite the fact that most of the population works in the informal sector. Analysis of both government data and evidence collected through stakeholder interviews suggests that this limited connection has prevented such TEIs from having a positive impact on the development of SMEs in Ethiopia.

Although evidence of impact via research output could not be identified at macro level in any of the included studies, some studies indicated impact at local level. Despite the lack of aggregate evidence in his study, Ca (ibid.) did identify a number of examples of

university-generated research that had improved the productivity of local agriculture and aquaculture. Collins (2012) found similar evidence of impact on local-farmer capacity in Rwanda. Magara et al. (2011) demonstrate evidence of impact on the efficiency of local-government systems, resulting from internship placements of library and information-science students in local government offices. Although all of these studies are quite small in scope, they indicate some evidence of transfer of technology from TEIs to small, local industries. One additional title warrants reference in this section, although it was not included as a title for synthesis. In 2003, the African Network for Agroforestry Education convened a symposium entitled, *Rebuilding Africa's Capacity for Agricultural Development: The Role of Tertiary Education* (Temu 2004). In the symposium summary, four chapters describe research projects that have improved the productivity of local natural resources in Kenya and Cameroon. These titles were not included for synthesis, as none of them explicitly links TE to development. However, the fact that the authors were all faculty members at local universities suggests that research conducted within TEIs may be having an impact on the productivity of small-scale local industries in these contexts.

In the aggregate, there is very little macro-level evidence that TE contributes to development in LLMICs through research and innovation. However, there is some evidence to suggest that the proportion of workers with higher education within a given context may increase the likelihood of technological uptake and adaptation. There is also limited evidence that research outputs may impact development by increasing the productivity and efficiency of SMEs. However, evidence of such impact has only been identified at local level. The small amount of available empirical evidence related to this potential pathway of impact indicates that this is an under-researched area that warrants further exploration.

5.4 Evidence of impact through improved capabilities

Key finding:

A number of studies showed a positive impact of tertiary-level study on graduates' capabilities. Impact was shown in areas of health, nutrition, political participation and women's empowerment. In some cases, the effect of TE was not always sufficient to overcome barriers in society (for example in the case of women's empowerment).

The studies grouped together in this section, and in the following section on institutions, relate principally to non-economic impact—that is, on health, nutrition, political participation and so forth. In fact—and as the endogenous development literature argues—these forms of outcome will often have a feedback effect on economic growth, but they are distinguished by the fact that they are non-market impacts above and beyond earnings. As such, they fit broadly into the 'human development' paradigm. In spite of the fact that there is potentially a very broad range of areas covered here, there are relatively few studies in comparison to those focusing on earnings and productivity.

A distinction is made here between the impact on *capabilities* and that on *institutions*, the former (cf. Sen 1980) focusing on the effect on individuals' wellbeing and agency, and the latter on the maintenance and development of societal organisations and practices. As discussed further below, there is clearly a good deal of overlap between the two.

By far the most extensive and systematic treatment of these forms of benefits of education in low- and middle-income countries is found in the work of McMahon (e.g. 1999). Some of these are private non-market benefits (for instance, health, longevity, reduced infant mortality, smaller families, non-monetary job satisfaction, enhanced cognitive development of one's children), and some are social non-market benefits (for example, democratisation, rule of law, human rights, lower crime rates, environmental improvements, community volunteering, greater knowledge dissemination). According to calculations drawing on a wide range of studies, McMahon (2003) estimates that just the private non-market benefits of education in developing countries provide an additional return above and beyond earnings valued at about 80% of the earnings benefits. While these figures are not explicitly disaggregated for TE, as opposed to secondary or primary levels, McMahon shows that these are likely to be roughly proportional to the market benefits at each level.

There are a further 22 studies identified as showing outcomes of enhanced capabilities. In terms of regional spread, 12 of these focus on Sub-Saharan Africa, seven on South or South-East Asia, one on the Middle East and two are global in scope. Methodologically, the majority (16) are quantitative observational studies, with two qualitative and four using mixed methods. These studies relate almost in their entirety to the teaching 'pillar', gauging the effect of TE study on the subsequent attitudes, capacities and behaviours of graduates; just one (McMahon 1999) relates to a combination of the pillars.

The studies relating to the capabilities pathway can be grouped in three main categories: citizenship and political participation; health and nutrition; and women's empowerment. There are three further studies considered that do not fit neatly into these categories, relating to employment and inclusion of people with disabilities.

5.4.1 Citizenship and political participation

There are a small number of studies assessing the impact of TE in LLMICs in the political sphere. Impact of TE in this area can be seen as constitutive of development—that is, if a democratic, participatory society is in itself a source of value—but is also instrumentally valuable in enhancing citizens' capacities to hold government to account, ensure provision of public services of quality, keep in check abuse of public office, and so forth. Two of these studies will be discussed in this section, and a further six in the following section on institutions. However, the sections are strongly interlinked, since citizens' effective participation is enabled by political structures and norms, and good governance and healthy democratic institutions are sustained by an informed and active citizenry.

In a survey of current third-year students in Kenya, South Africa and Tanzania, Luescher-Mamashela et al. (2011) found that TE enhances democratic attitudes and behaviours. There are some divergent results, but, in comparison with those with a lower level of education, students were generally found to have better access to political information, be more critical of the political system, and participate more in voluntary organisations, protests and other political activity. Stimulating on-campus activity and student leadership is seen as the most effective way of enhancing civic participation. However, 'The findings are also consistent with a potential "hothouse effect", whereby high levels of citizenship involvement might disappear once a student leaves university' (p. xvi). Mattes and Mughogho (2009), in contrast, show more ambivalent results in their analysis of

Afrobarometer data⁷ on 18 countries in Africa. While higher levels of formal education are generally seen to enhance political awareness, interest and, to some extent, participation, higher education students in this survey showed few differences from high-school graduates.

5.4.2 Health and nutrition

Completing TE is associated with better health and well-being outcomes (as well as attributes conducive to healthy lives) in a range of studies. For example, graduates in Bangalore, India, are seen to have higher rates of subjective well-being than those with lower educational levels (Agrawal et al. 2011). In south-western Nigeria, elderly men (aged 60-90) with university education were significantly less likely to report psycho-social problems than those with lower levels (Akinyemi 2012). In the states of Bihar and Maharashtra, India, education was significantly associated with knowledge about the health risks of smoking, with those people of tertiary-level education having higher knowledge than those with only secondary, primary or no education (Sansone et al. 2012). Education was found to be a stronger predictor of knowledge about the health risks of smoking than income.

According to Ahmed (2010), education in Sudan is associated with lower fertility, with women of university education having an average of 33% fewer births than the country average (50% in urban areas). In this study, primary education is seen to be insufficient to induce a large change in behaviour. Akin's (2005) study of 14 Middle Eastern countries (including Iraq, Syria and Yemen) showed that secondary-level education of women is significantly associated with lower rates of fertility, while, for men, it is associated with higher rates. TE is also associated with lower rates, but is not statistically significant (possibly because the data are not disaggregated by gender and the effects on males and females may be cancelling each other out).

There are two studies providing evidence of the link with nutrition. Survey data in 48 developing countries in Africa, Asia and Latin America show that education is strongly correlated with lower levels of food insecurity in rural populations. However, this association is strongest with primary education, with the relationship decreasing at secondary and tertiary levels (Burchi and De Muro 2007). In East Timor, however, Raghbendra and Dang (2012) found that TE of the household head was significantly associated with higher levels of food adequacy, and was more influential relative to lower levels of education.

The above studies show associations between having studied at tertiary level and various health outcomes— relating, in other words, to the teaching 'pillar' of TE. One study, however, showed the impact of the 'service' pillar, in the form of a community-based medical-education programme in Nigeria (Omotara et al. 2004). Community leaders reported positive perceptions of the impact of this university-led programme on their communities, including: increased awareness of preventive aspects of communicable and non-communicable diseases; increased participation in public-healthcare activities; formation of local health co-operatives; and improvements in personal hygiene and in sanitation and oral-rehydration practices.

⁷ Programme of public surveys on social, political and economic attitudes repeated periodically across Africa.

Finally, Tilak (2003, 2010) argues that, contrary to the presumption of many policy-makers, TE is influential not just on economic growth, but also on a range of aspects of social development. In an analysis of data across low-, middle- and high-income countries (and, in the earlier publication, specifically in relation to Asia), TE is found to have a significant reductive effect on the rate of infant mortality, to increase life expectancy, to lower fertility rates and to improve a country's position on human development and gender-based development indexes. Using data for African countries from 1960-2008, Gyimah-Brempong (2010) shows that, across the region, TE is strongly linked to lower rates of HIV/AIDS prevalence. While primary and secondary levels are seen to be most influential in terms of infant mortality and preventive health (for example, immunisation), TE is found to be more strongly linked to curative health (for example, combating tuberculosis) and longer life expectancy.

5.4.3 Women's empowerment

While access to TE for women has increased rapidly throughout the world, and is higher than that for men in a number of LLMICs, it does not always translate into equal participation and opportunities in the broader society. This group of studies assesses the impact of TE on women's capabilities, with divergent findings. Gyimah-Brempong (2010) shows a correlation in the African region between TE and a higher proportion of women parliamentarians (the link is stronger than that with primary and secondary levels). Malik and Courtney's (2011) mixed-method study indicates a strongly positive effect of study in public universities in Pakistan, not only on women's economic independence resulting from earnings, but also on their voice and confidence in participating in family and community affairs, and increased awareness of legal rights—although there remain significant social barriers to exercising these rights. In Eritrea, access to university is seen to enhance women's freedom through enhanced earning capacity, avoidance of restrictive marriages and enhanced choice of future life trajectory in relation to career, travel and further study (Müller 2004). Higher education for women is also associated with greater confidence and less emotional dependence on a spouse, as shown in a study of Sikh families in Punjab, India (Singh et al. 2006).

However, DeRose et al. (2002) found that higher levels of education in Ghana, including TE, do not necessarily ensure women's control over reproductive decisions (that is, how many children to have), although female students from the University of Ghana had a lower acceptance of men's unilateral decision-making as regards childbearing than women with lower levels of education in that country. Further ambiguous results are presented in Dalal (2008): while being a higher education graduate is seen to reduce the risk of domestic violence for women in Kenya, having a higher level of education than one's partner can actually increase the risk. Among current university students (both male and female) in Jakarta and Makassar, Indonesia, despite expectations of a dual-earner marriage, men are considered to be the primary breadwinner (Utomo 2012). This positioning is seen as a way for women to accommodate their desire for financial independence with their primary responsibilities as wives and mothers.

TE, therefore, is seen to have an empowering effect on women in diverse contexts, yet, in many instances, it is insufficient to overcome deeply ingrained social norms.

5.4.4 Other studies

Three further studies were included in the review. The first also relates to empowerment, but, in this case, for people with disabilities. Barriers for higher education students with disabilities in countries like Tanzania are considerable, as shown by Mwaipopo et al. (2011). Access to higher education, however, does confer a range of benefits, including the development of a sense of self-worth and confidence and the building of skills for leadership through involvement in student organisations—although the evidence is restricted to a few cases. Students also perceived that attitudes in the broader society would be changed simply by virtue of the presence of people with disabilities in university (that is, by the potential effect on institutions).

Much discussion of employment and earnings has taken place in the preceding sections. However, there are aspects of employment that go beyond financial returns, involving capability to participate in rewarding and beneficial work. Al-Samarrai and Bennell's (2007) tracer study in Malawi, Tanzania, Uganda and Zimbabwe found that, contrary to expectations, nearly all graduates surveyed for the main national universities in each country were in employment, and in jobs directly related to their university education. These rates were significantly higher than those for people with only secondary-level studies. In addition, employment rates were similar or higher for women than men. Thomas (2008) also shows significantly higher rates of employment of graduates of higher education, including those with post-secondary vocational qualifications, than for those with secondary level, in this case among returning migrants in the context of Uganda. Interestingly, for higher education graduates, the likelihood of returning Ugandan migrants obtaining employment was higher than that of non-nationals.

TE, therefore, in a number of instances, has been seen to have a significant effect on enhancing graduates' capabilities. However, in some cases, the effects are not powerful enough to overcome societal barriers. The evidence is mixed as regards the benefits of TE in relation to other levels of education, with some studies showing declining returns, and others showing the tertiary level to be the most significant. In addition, as with all of the pathways, there is the caveat that research findings that indicate a lack of impact may be due to failings in the 'assumptions' (for example, poor quality of teaching in TEIs), not because of lack of transformative potential of TE.

5.5 Evidence of impact through improved institutions

Key finding:

There are a small number of studies showing a positive impact of tertiary-level study on the strengthening of institutions (both formal organisations and social norms). Impact was shown in areas of governance, public services and the environment.

Without attempting to provide a definitive stipulation for the term, institutions are here taken to refer to formal organisations and social practices or norms that govern behaviour in a given society. There were 13 studies included in the institutions category, including Gyimah-Brempong (2010) and the two studies authored by McMahon (1999, 2003) referred to in the previous section. There is a broad geographical spread, with five being global studies, four on Sub-Saharan Africa, three on Asia and one on the Pacific Islands. Eight

studies were quantitative, two qualitative and three used mixed methods. Once again, the selection was dominated by the teaching pillar, with just three relating to a combination.

5.5.1 Democratisation, governance and political institutions

The benefits of higher education for political institutions shown in McMahon (1999, 2003)—for example, in supporting democracy and the rule of law—are discussed above. The influence of TE on political institutions can relate either to the formal structures of the political system, or to the underpinning attitudes and norms in society. In relation to the former, Mattes and Mozaffar (2011) assess the performance of legislative representatives in 11 countries in Africa and find significant differences between those that have TE and those that do not, showing the former to be more effective legislators and more closely committed to advancing the work of the legislative than of party or constituency. Keller's (2006) analysis, using worldwide panel data, shows a link between expansion of tertiary enrolment and guarantees of political rights, while TE is also linked to increasing political stability across the African region in Gyimah-Brempong (2010).

As regards political attitudes and norms, Shafiq (2010) found that higher education has a positive association with democratic attitudes in Pakistan, and is a stronger predictor than just secondary, primary or no education. (Another lower-middle-income country, Indonesia, was included in the study, but no statistically significant relationships were identified.) This is particularly interesting, given that the association between higher levels of income and democratic attitudes was inconclusive. In a survey of residents in Kathmandu, Nepal, higher education was seen to be influential in changing attitudes towards corruption, with less accepting attitudes shown with each level of education (Truex, 2011). University graduates were found to be less tolerant of corruption than high-school graduates in this study.

In a global study of 'youth bulges' and political violence, Urdal (2006) shows one potentially negative finding, as he identifies an association between increased levels of higher education and a greater risk of terrorism. This link is seen to apply primarily to contexts in which graduates are unable to find employment upon leaving university—so it does not, in itself, constitute evidence of a negative effect of higher education study.

5.5.2 Public services

A key impact of TE is through the formation of professionals for vital services such as healthcare, education and social work. Due to the nature of the database search, relatively few titles of this form were included in the main review, but four will be summarised in this section. In forming these professionals, TE has a dual effect, in that it enhances the capabilities of students directly, but also leads to the enhancing of capabilities of the general population through the subsequent work of graduates; that is, through teachers, medical workers, etc. The capabilities and institutional benefits, therefore, reinforce one another in this area.

Higher education is well-known for fostering mobility and, potentially, brain drain. However, in some circumstances, it can encourage key professionals to contribute to local and national communities: Oman et al.'s (2009) study on Fiji, for example, shows how local diploma-level training for doctors increased the likelihood of retention of the workforce, although the results are based on a small number of participants.

Harris and Lewer (2005) assess a Postgraduate Diploma in Conflict Resolution and Peace Preparedness in Sri Lanka, run in partnership with the University of Bradford. The programme was seen to be effective in fostering a sense of the importance of peace-related work in the local area, but also in enhancing the capacity of key professionals working in the field (including police, military and local-government administrators), with benefits including: new career opportunities; enhanced knowledge, skills and confidence; and capacity building for other colleagues.

For groups such as refugees, staffing of essential public services is particularly crucial, and access to higher education particularly difficult. Wright and Plasterer (2010) show the benefits of higher education, not only to the individual refugees in Kenya who have access, but also to the broader community; teacher education courses, in partnership with Kenyan universities, have increased the supply and quality of teachers for primary schools in the camps, and access via distance learning or scholarships to other higher education courses, such as community development and public health, have benefited the refugee camps through graduates' subsequent work for UN agencies and non-governmental organisations (NGOs).

This form of impact is mainly through the teaching pillar, but can also occur through service. Magara et al. (2011) show a strengthening of local government management capacity in Uganda through library and information services internships from Makerere University, with the interns updating information systems and transferring skills.

There is a final study that is distinct from these two categories, as it assesses the influence of TE in shaping social norms relating to the natural environment. In a study of 51 developing countries, a significant association was found between increasing rates of TE access and a slowing of the rate of deforestation (Ehrhardt-Martinez 1998) (figures are for 1965-80). Universities are seen to be influential in raising awareness of environmental issues, fostering activism and social mobilisation, and developing and adapting new technologies.

In summary, the small number of studies that were identified in the main review provide consistent evidence of TE strengthening institutions (with the possible exception of Urdal [2006]), both in terms of formal organisations and positive social norms.

6. Barriers to impact

The above sections have summarised the key findings of the main review in relation to diverse development outcomes. Although the results of our synthesis suggest that TE has a positive impact on many aspects of development in LLMICs, some of the included studies suggest only limited impact. Although such findings cannot be ignored, it is important to acknowledge that these findings do not necessarily indicate that TE *cannot* have a positive impact on development.

As discussed in sub-section 2.2, we were conscious from the outset that the pathways outlined in the conceptual framework rest on a number of assumptions related to the functioning of TE and its relationship with the surrounding environment. Given the historical background of TE systems in many LLMICs, we presumed that these assumptions would not hold in many of the contexts under consideration in this review, and we intended to investigate how such conditions might affect the impact of TE on development in LLMIC contexts.

6.1 Evidence from the literature

Although very few of the 99 included studies contain explicit references to any of the underlying assumptions outlined in sub-section 2.2, we identified some that investigated these factors as potential barriers to impact. For instance, four of the studies considering the role of TE in technological transfer include empirical analysis of factors that are likely to restrict the ability of TEIs in LLMICs to affect innovation, such as low levels of research output, limited financing for R&D, and limited links between TEIs and industry. Other studies include references to a number of underlying assumptions in the discussion of empirical results, but do not contain any explicit investigation of the extent to which such factors affect the impact of TE in lower-income contexts (see, for example, Al-Samarrai and Bennell 2007, Rolleston and Oketch 2008).

Although not always an aspect of research considering the impact of TE, we did find that many of these factors were the subject of empirical research in their own right. In order to present a complete picture of the role of TE in development in LLMICs, it would have been useful to conduct a separate investigation into the findings resulting from this body of literature. This was not feasible within the limits of the current review. However, as discussed in sub-section 3.2, we did find that many of the studies included in our initial list of relevant literature explicitly considered some of these underlying issues. Although these titles were not included in our overall synthesis, given that none of them explicitly analyses impact, we elected to retain them in the review, as we felt they provide useful insights into the breadth of literature available in this domain.

By the end of the screening process, we had identified 517 studies that addressed at least one of the assumptions underlying the conceptual framework. These studies were identified through our initial search strategy and not through a search focused explicitly on these topics, so this body of literature cannot be viewed as exhaustive of all of the available evidence on this topic. However, it does provide a useful overview of the myriad factors that are likely to act as barriers to impact in LLMICs. Although it was not possible to consider the findings of these studies in any depth, we were able to review the study

abstracts and determine which assumptions they considered. A brief summary of these findings is included as Table 6.1, below.

Table 6.1: Summary of ‘assumptions’ literature⁸

Assumption addressed	Number of titles
Sufficient quality of teaching	236
Sufficiently diverse student population	193
Existence of high-quality research and innovation	79
Existence of a supportive, enabling environment outside the university (support for entrepreneurship, links with industry, etc.)	78
Adequate proportion of eligible population enrolled in TE	53
Limited migration of TE graduates (that is, limited brain drain)	45
Supportive institutional governance	41
Existence of academic freedom	22
Adequate range of disciplines and academic subjects	21
Existence of postgraduate programmes	18
Sufficient lower levels of education	15

Although the findings of these studies were not analysed in any detail, this cursory review of the abstracts provides a clear indication that these conditions cannot be presumed to be present in many LLMIC contexts. It therefore seems more useful to refer to them as ‘limiting factors’, rather than ‘assumptions’. As these limiting factors clearly affect the pathways to impact outlined in the conceptual framework, this body of supportive literature provides an important explanation for the findings of the main review. The vast literature on quality of teaching is particularly important, given that most of the studies included in this review analyse pathways to impact that rest on improved graduate capacity. Studies considering the inequitable nature of many TE systems also provide useful context for some of the findings related to improvements in capabilities, while the literature considering limited research output provides insight into the findings related to limited technological transfer. It is clear that these barriers must be overcome in order for TE to have a more substantial impact on development in LLMIC contexts.

6.2 The critical role of context

Although similarities in the history and circumstances of TE systems across the developing world have allowed us to draw general conclusions about the ability of TE to impact development in such contexts, it is clear that the particular pathways—and barriers—to impact differ between individual national contexts. In order to consider the impact of such contextual factors, the particular situations of two national TE systems were analysed. Given the wide variation in circumstances across the countries included in the scope of the review, we elected to concentrate on two countries within the same region that demonstrate how diversity in historical circumstances and enabling environments can affect the role of TE in development. We first considered the case of Kenya, a country with a long history of TE, before turning to the case of Rwanda, a country that has recently redeveloped its TE system. Given space constraints, we were unable to include these case studies in the body of the report. However, we have included them for reference as Appendix 7. Examination of the case studies was instructive during our

⁸ Some of the studies addressed more than one assumption, so the frequencies do not total 517.

formulation of our conclusions and recommendations, so they will also be referenced further in Section 8.

7. External aid to TE in LLMICs

7.1 Identified studies on external aid and interventions

As discussed in sub-section 3.2, the search process identified a number of studies that attempt to assess the impact of particular TE interventions. Although most of these studies could not be considered in the main body of the review, given that they do not seek to analyse the impact of TE interventions on development outcomes, they do provide an overview of the types of reforms and interventions that have been attempted in an effort to improve the functioning of TE systems and institutions in LLMICs. As external aid has played an important role in the history of TE in lower-income contexts, we felt that these studies could provide useful supporting evidence to inform the findings of the central review. As with the ‘assumptions’ literature, the interventions studies were identified through the main search strategy undertaken for the central review question, and not through a specific search, targeting TE interventions. As such, the identified studies cannot be considered to give exhaustive coverage of the wider body of literature on TE interventions in LLMICs, particularly given that much of the literature on interventions is retained by sponsoring organisations and is therefore less likely to feature in bibliographic databases. Given time and human-resource constraints, it was also not possible to appraise the quality and rigour of these studies. Analysis of their content, therefore, cannot provide any empirical evidence as to the relative effectiveness (or cost-effectiveness) of different interventions within or across contexts. However, the information contained in the studies does offer important context for our central review question by demonstrating trends in external aid to TE and exposing areas that would benefit from further empirical research.

By the end of the screening process, 103 studies had been identified that empirically investigate the impact of TE interventions in LLMICs⁹. None of these studies attempts to capture the impact of such interventions on broader development outcomes, but all present evidence regarding the effectiveness of the interventions under consideration in terms of the proximate outcomes of the interventions (for example, increased research outputs or improved institutional efficiency)¹⁰. In line with the wider inclusion/exclusion criteria used throughout this review, we did not engage with studies focusing exclusively on financing reforms. We also elected to focus on interventions located within LLMICs. Studies about degree courses provided to LLMIC country nationals in higher-income countries were, therefore, excluded from the review¹¹. The only exception to this rule was the inclusion of bilateral scholarship programmes; as these interventions are of particular interest to the donor community, we elected to include any studies pertaining specifically to scholarship impact.

⁹ Any title describing an intervention, but not discussing its impact or effectiveness, was not included in this summary.

¹⁰ A previous literature review (Creed et al. 2012) also showed that aid interventions uniformly *identify* expected development outcomes, but tend not to *measure* them, restricting their evaluations to the success of the intervention in terms of proximate outcomes, such as the improved capacity of individuals or institutions.

¹¹ A few interventions featured in multiple publications. If the individual titles discuss the same aspects of the intervention, only one title was retained for analysis in this summary.

7.2 Mapping the available evidence

Once the 103 studies were identified, the full-text articles were reviewed and classified in terms of a number of descriptive variables. The studies were first organised into two groups: studies pertaining to interventions led and/or funded by external organisations; and studies pertaining to nationally funded interventions. Of the 103 studies, 40 referenced purely domestic initiatives, such as the development of regulations to guide privatisation within a national TE system. We elected to set these studies aside and focus exclusively on the 63 studies related to external interventions.

Within the group of 63 titles, 11 would best be described as summary titles, as they combine findings from multiple studies. All of the remaining 52 titles present the findings from one individual study. In terms of geographic context, more than half of the studies discuss initiatives located in Sub-Saharan Africa (32 studies). There are also a number of studies based in South or South-East Asia (13 studies). Four studies pertain to North Africa and the Middle East or the Pacific Islands, and two pertain to East Asia or Latin America and the Caribbean. As with the studies included in the main review, the regional distribution is likely to be affected by our exclusive focus on LLMICs and our reliance on literature written in English. Ten of the studies look at interventions across the range of LLMICs¹². Within the African context, the majority of studies focus on interventions located in Kenya (nine studies), Malawi (eight studies), Tanzania (seven studies), Uganda (seven studies), Mozambique (six studies), Ghana (five studies) or Zimbabwe (five studies). Indonesia (seven studies) and India (six studies) are mentioned most frequently in the Asian literature. Other countries featuring in five or more studies include Egypt and the Philippines. More than one study mentions interventions based in Ethiopia, Nigeria, Vietnam, Zambia, Fiji, Papua New Guinea, Cambodia, the Democratic Republic of Congo, Madagascar, Morocco, Pakistan, Palestine and Senegal, while Bangladesh, Bolivia, the Central African Republic, Gabon, the Gambia, Guyana, Ivory Coast, Lao, Lesotho, Mongolia, Nicaragua, Sudan, Syria and Yemen are mentioned in one study each. This country breakdown represents more individual countries than were identified in the main portion of our review, which suggests that TE interventions are implemented in a wide diversity of LLMICs.

Of the 63 studies, 39 discuss interventions relying on the participation of at least one foreign TEI¹³. Thirty focus on interventions funded by bilateral organisations, while 25 of the studies reference interventions funded and/or organised by NGOs. Multilateral organisations, such as the World Bank or the UN, funded the interventions mentioned in 19 studies. Four of the studies also mention the sponsorship of a foreign private corporation¹⁴. In addition to the type of external partner, the studies were classified by the specific type of TE intervention, both in terms of the intervention model and the

¹² As with the studies included in the main review, some studies focus on multiple regions and/or intervention types, so the numbers in this section do not always add up to 63.

¹³ In order to be classified as an intervention involving an external TEI, at least one partnering institution had to come from a high- or higher-middle-income country. Regional networks consisting exclusively of institutions from LLMICs were classified as ‘networks’, not as partnership programmes.

¹⁴ Many studies mention multiple partners, such as partnership programmes funded by bilateral organisations and implemented by foreign TEIs. These studies are counted in both categories.

intended outcome(s). The breakdown of studies by intervention type is outlined in Tables 7.1 and 7.2, below.

Table 7.1: Breakdown by intervention model¹⁵

Intervention model	Number of titles
Provision of short-term training or workshops for faculty and/or administrators	36
Institutional capacity building (comprising infrastructural reforms, initiatives aimed at increased faculty teaching or research capacity, and measures aimed at improving governance and/or managerial capacity)	34
Creation of a network of TEIs	17
Introduction or expansion of online or distance education	17
Provision of foreign undergraduate or postgraduate scholarships to students or faculty members	15
Provision of complete degree courses by a foreign institution (either online or in person)	11
System-wide capacity building (typically focused on system-wide efficiency measures and/or infrastructural reforms)	6
Provision of blended-mode trainings, combining short-term in-person workshops with distance supervision of longer-term projects (typically focused on faculty members)	6

Table 7.2: Breakdown by intended outcome of intervention

Intended outcome	Number of titles
Increased research output	34
Expanded or revised curriculum	31
Improved teaching capacity of faculty members	23
Expanded access to postgraduate programmes	19
Improved institutional efficiency	17
Improved institutional governance	17
Modification of the range of available academic subjects (comprising both interventions intended to increase the diversity of subjects and those intended to focus on particular fields of study, such as science and technology)	12
Improved and/or expanded links with industry	9
Increased access to TE (either in terms of absolute numbers or increased diversity of the student population)	9
Improved student-learning outcomes ¹⁶	7
Expanded links with surrounding community	1

¹⁵ All of the individual interventions mentioned within a summary title have been included in these counts.

¹⁶ Of these seven titles, three pertain to foreign scholarship programmes, as we assumed that most scholarship programmes are intended to improve student-learning outcomes by offering participating students the opportunity to benefit from high-quality foreign education. The other four titles included in this group aim to assess improvement in student-learning outcomes resulting from interventions based at institutions within LLMICs.

Roughly half of the studies focus explicitly on interventions within public TE systems and/or institutions (31 out of 63). Some of the interventions are exclusive to medical schools (11 studies). Others are based in teacher-training colleges (eight studies) or technical institutions (four studies). Research universities feature in 24 of the studies. Of the 63 studies, ten reference interventions that do not involve any local TEIs. All ten of these studies discuss degree courses located within LLMICs, but provided exclusively by foreign institutions. Many of the studies focus specifically on one institution (24 studies), while others discuss interventions at multiple institutions within one national context (13 studies) or multiple institutions in multiple national contexts (26 studies).

In terms of the research design employed by the studies, we first classified the purpose of the individual studies. Of the 63, only 22 explicitly attempt to capture impact empirically. The remaining studies have alternative purposes, such as highlighting challenges and/or opportunities of particular intervention models. This distribution is reflected in the research methods used, as most of the studies rely on qualitative (17 studies) and/or mixed-method (26 studies) designs that allow for the exploration of participant perspectives. Five studies report results from ongoing action research. Only four can be classified as quantitative studies. Three of these are observational, as they report indicators such as student pass rates and examination scores, while only one was constructed as a quasi-experimental design¹⁷. In terms of the study population, most of the studies focus on faculty participants (31 studies). Although many of these studies involve interviews with local faculty members, many rely exclusively on the reflections of the author as an individual participant in the intervention. Eighteen of the studies focus on students, three on graduates, and four on administrators. An additional 13 studies consider interventions at institutional, rather than individual, level. One study considers employer perspectives on the outcomes of a particular intervention.

7.3 Discussion

When considered as a group, these studies provide an overview of the diverse range of TE interventions being implemented in LLMICs. The diversity of interventions referenced in the literature suggests that external agencies are attempting to improve the functioning of TEIs in a wide variety of ways, ranging from macro-level efficiency measures to small-scale partnerships aimed at increasing the capacity of individual academic departments. Much as the amount of international funding for TE has altered over time, the particular intervention models advanced by external agencies also appear to have risen and fallen in popularity over the years. Although it was not possible to analyse the historical trajectory of intervention models in any detail, it is clear from the dates of publication of the studies that certain models feature more prominently than others within particular time frames. This suggests that changing preferences within the donor community for particular types of interventions may affect the diversity of models being implemented within LLMICs.

Regardless of the specific model selected, the underlying assumption of most TE initiatives is that the intervention will improve the functioning of a given system or institution. Although some such improvements may be desirable in their own right, most organisations justify their interventions in terms of wider development outcomes, suggesting that

¹⁷ The 11 summary titles were not coded on this variable, as the individual studies within the summaries often used varying research methods.

improved TE functioning will increase the likelihood that TE will impact development in a given context. In Section 6, we discuss a number of limiting factors that appear to restrict the ability of TE to impact development in LLMICs. Given the developmental objective of many TE interventions, it would seem likely that existing interventions would attempt to address many of these limiting factors. Although there is a clear correlation between the list of limiting factors included in Table 5 and the intended outcomes of the interventions referenced in Table 7, it does not appear that the limiting factors attracting the most attention within our limited sample of literature receive equal prioritisation within the interventions literature. For instance, the quality of education provided by TEIs was the most frequently mentioned area of concern within the ‘assumptions’ literature. Although 23 of the intervention studies mention improved teaching capacity as an intended outcome, most imply that pedagogy will improve if faculty members are provided with training and/or opportunities to complete postgraduate degrees. Only four studies mention any attempt to evaluate the effectiveness of such strategies by assessing student-learning outcomes. Similarly, the issue of equity is of paramount concern within the wider literature on TE in LLMICs. However, only nine of the intervention studies address questions of access, and most of these focus on general expansion of access, rather than increasing diversity within the student population. The purposive nature of our sample of assumptions and interventions literature clearly prevents any firm conclusions being drawn around this point. However, other analyses of the current TE-reform agenda (see, for example, Mamdani 2007) have raised similar concerns about a potential mismatch between barriers to impact and intervention priorities. This would appear, therefore, to be an important area for future research.

Of equal concern is the limited amount of evidence linking TE interventions to development impact. Although the studies referenced in this section do not include any discussion of development impact, a handful of studies included in the main review do discuss the developmental impact of particular interventions. For instance, Harris and Lewer (2005) demonstrate some evidence of impact of an externally funded postgraduate programme in peace education on the functioning of local government and other institutions in Sri Lanka. Wright and Plasterer (2010) show the benefits of externally supported higher education on populations of refugee camps in Kenya¹⁸. However, these studies appear to be the exception to the rule. The vast majority of studies investigating interventions focus exclusively on intended outcomes, rather than seeking to capture any wider development impact.

¹⁸ One additional study from the main review—Dargie et al. (1993)—presents evidence of impact of a joint research partnership between the Netherlands Directorate General of Development Co-operation and local research universities on animal productivity and health in a number of countries in Sub-Saharan Africa. However, this study was excluded during the quality-appraisal stage.

8. Discussion and conclusions

This final section provides a summary of the main findings of the review, assesses the strength of the body of evidence, identifies gaps in existing research and draws out implications for the conceptual framework and future research agendas.

8.1 Key findings

The studies included in this review suggest that TE does have an important impact on development in LLMICs. However, it appears that TE may have a stronger impact on some outcomes than others. Other areas have not yet been researched sufficiently to allow for any firm conclusions. In this section, we assess the strength of the overall body of evidence discussed in this review, highlighting the four criteria (size, quality, context and consistency) suggested by the DFID 'How to note' on 'Assessing the strength of evidence' (DFID 2013).

8.1.1 *Size of the body of evidence*

The simplest, and most important, finding of this study is the lack of research that assesses the impact of TE. Despite the large body of literature on this level of education in LLMICs, only a small number of studies identified (99 in total) actually provide robust empirical evidence of the way(s) in which TE affects society. The number of studies is insufficient to draw firm conclusions about all of the pathways. In particular, there is a severe lack of studies gauging the impact of research and service; those studies that were included were predominantly focusing on the teaching pillar¹⁹. There is also a significant lack of evidence related to a number of important outcomes of TE, including productivity, technological transfer and institutional development.

8.1.2 *Quality of the body of evidence*

Quality appraisal is discussed in detail in sub-section 3.3, so just a brief recap will be made here. Of the 147 studies remaining after full-text screening on relevance, 48 were excluded on the basis of quality. One concern is that the quality-appraisal process led to the exclusion of a number of studies investigating questions of interest to the review, and in which there is a lack of research—such as the impact of universities' service activities.

8.1.3 *Contextual considerations*

As discussed in Section 4, most of the included studies concentrate on Anglophone countries in Sub-Saharan Africa and South Asia, particularly the high-population countries of India, Pakistan, Nigeria, Kenya and Tanzania. There is a range of quantitative studies that draw on data from multiple countries (for example, Tilak 2010, Keller 2006), and from which broader conclusions can be derived. Most of the studies, however, are context-specific.

The limited number of studies overall prevents any systematic examination of effects within particular regional or national contexts, as the number of studies addressing

¹⁹ There was greater balance in the literature considered on interventions, with 53 studies focused on improving graduate capacity, 33 studies on improving research output, and 20 studies on improving services to the community.

particular pathways within regions is too small to allow for any meaningful analysis. However, the findings highlighted within each pathway do reflect evidence from a broad range of contexts.

8.1.4 Consistency of the body of evidence

In terms of consistency, most of the studies do show positive impact of TE, but there is divergence as to the nature and extent of this impact. Furthermore, as discussed in Section 6, those studies showing limited impact, or absence of impact, do not necessarily imply that TE is not a worthwhile investment of resources; rather, the lack of impact may be attributable to certain limiting factors, such as poor-quality teaching, a lack of facilities for research, ineffective governance of TEIs and barriers within the enabling environment. Very few studies show a *negative* impact of TE, although a few were identified (for example, Urdal 2006).

Much of the inconsistency within the literature can be attributed to the limitations of the included studies, particularly in terms of the available data and the methodologies used. There is a pronounced scarcity of macro-level data available for use in analysis of this topic. This lack is highlighted by the reliance of many of the included studies on the same datasets (for example, Barro and Lee 2000, World Development Indicators). The lack of comparability between datasets collected during different historical periods is also a significant problem for synthesis, particularly given ongoing changes in funding levels for TE systems in many LLMICs. Methodological differences between studies are also likely to contribute to inconsistencies in results. Some of the studies included in the review build an explicit time lag into their analysis (see, for example, Tilak 2010, McMahon 1999), while others do not. This is particularly important, given that the effects of education are not immediate. Some studies use contemporary enrolment rates as a proxy for TE, while others rely on attainment levels (that is, the proportion of the eligible population having completed TE, as opposed to other levels of education). Diversity in the control variables used also makes it difficult to isolate the impact of TE at macro level. For instance, TE study may be found to be associated with better health outcomes, but greater family wealth may actually be causing both. Without explicitly considering all of the relevant variables, it can be hard to disaggregate the impact of TE from other effects.

8.1.5 Strength of the body of evidence

The table below summarises the available evidence in relation to the outcomes of TE considered in this review. The size and consistency columns reflect the analysis from the sections above. For 'size', any grouping with fewer than 20 studies is classified as 'small', while 'medium' is used for groups of 20-40 studies. 'Consistency' refers to the consistency of the body of evidence in terms of the existence of a positive impact. Some evidence groupings, such as the evidence around economic growth, may be inconsistent in their *comparative* conclusions (that is, when relating TE to other levels of education). However, if the studies in the group are consistent in indicating that TE does contribute to a given outcome, we have classified the group of evidence as 'consistent'. 'Quality' was not included in the summary table, as all included studies met the necessary standards assessed during quality appraisal. 'Context' was also not included, as the 'How to note' recommendation of classifying groups of studies as either 'global' or 'context-specific' does not really apply to a review of this scope. As discussed above, each group of studies

reflects findings from a broad range of contexts, but the impossibility of identifying an effect that applies in exactly the same manner across all contexts prevents the use of the term ‘global’ when classifying this body of evidence. The ‘overall strength of evidence’ column is a combined assessment, based on the size and consistency of each grouping.

Table 8.1: Strength of evidence summary table

OUTCOME	CHARACTERISTICS		
	SIZE	CONSISTENCY	OVERALL STRENGTH OF EVIDENCE
Individual Earnings	Large (48)	Consistent	Strong
Economic growth	Medium (25)	Consistent	Medium
Productivity	Small (13)	Inconsistent	Limited
Technological transfer	Small (8)	Inconsistent	Limited
Capabilities	Medium (24)	Consistent	Medium
Institutions	Small (13)	Consistent	Medium

8.1.6 Discussion and conclusions

The key findings of the review can be summarised as follows:

1. The returns to TE have largely been underestimated.
2. In addition to having a strong impact on the earnings of graduates, there is some evidence to suggest that TE has a positive impact on productivity in the workplace.
3. There is also evidence that TE has a stronger impact on macro-level economic growth than was previously assumed. The impact of TE on income equality is more difficult to isolate and appears to vary significantly depending on context.
4. Although there is very little evidence that TE contributes to development in LLMICs through research and innovation, the proportion of workers with higher education within a given context appears to increase the likelihood of technological uptake and adaptation. There is also limited evidence that research outputs may impact development at local level by increasing the productivity and efficiency of SMEs.
5. TE appears to have a strong positive impact on graduates’ capabilities, including health, nutrition, political participation and women’s empowerment, although the effect of TE is not always sufficient to overcome entrenched barriers in society.
6. TE also appears to have a positive impact on the strengthening of both formal institutions and social norms, in areas such as governance, public services and the environment.
7. Evidence of impact at micro level is more robust than at macro level, given the lack of available macro-level data, methodological inconsistencies between studies and the likely barriers to impact in many LLMICs.

When taken as a whole, the body of evidence analysed in this review, therefore, suggests that TE plays an important role in both economic and non-economic development in lower-income contexts. For years, much of the international literature on TE in lower-income contexts emphasised the private benefits to individuals. However, recent studies have indicated that investment in TE also yields significant social returns, both in terms of economic growth and in terms of non-economic benefits. The included studies show a consistent positive impact of TE on societal institutions and on a range of capabilities that have public, as well as private, benefits. There is also evidence that TE has a positive impact on the natural environment. Although a small body of evidence, the consistency of

evidence linking TE to non-economic benefits is particularly important in light of recent policies in many LLMIC contexts, which have moved TEIs towards an increasingly narrow focus on employment and earnings. An example of this was shown in the review, with the orientation towards human capital in the Eritrean university system in danger of undermining social solidarity (Müller 2004).

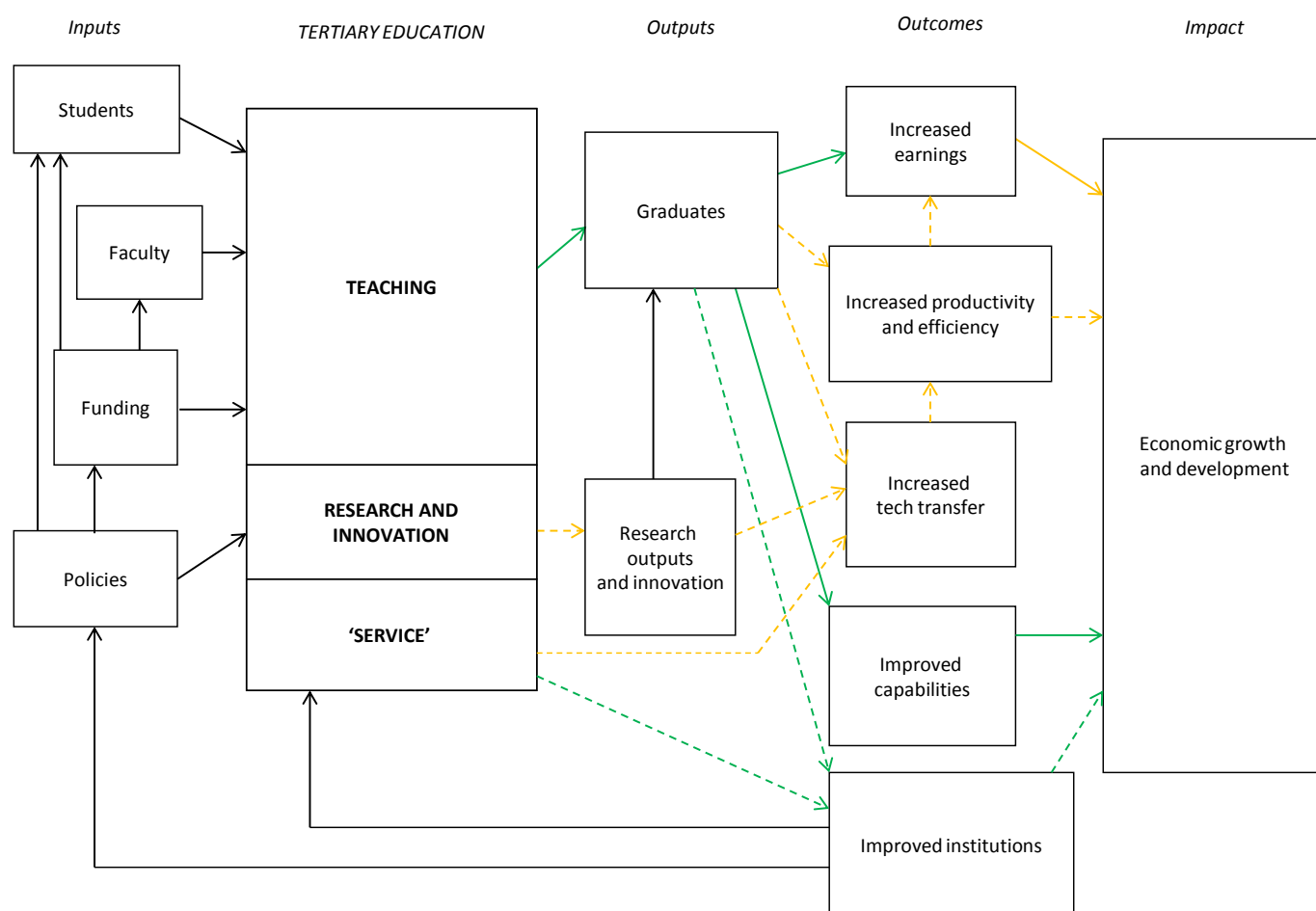
The impact of TE in terms of poverty reduction was harder to analyse, given the severe lack of evidence on this topic. To a large extent, access is still restricted to those of a high socio-economic status, and the prior education and economic advantage of parents determine the educational progression and life chances for their children. Although access policies have come into effect in many LLMICs, we could identify few studies that investigated how such policies have impacted inequalities within society. We also found very few studies that consider the relationship between TE provision and absolute poverty levels in LLMICs. We did, however, identify a few studies that indirectly examined TE's impact on poverty reduction through the formation of pro-poor professionals (for example, Oman et al. 2009) and through direct service to local communities (for example, Collins 2012).

8.2 Revisiting the conceptual framework

As discussed in Section 2, the conceptual framework used to guide this review was developed primarily with reference to literature from OECD countries and was therefore positioned as a 'working hypothesis' during the review process. From the outset, we intended to revisit the conceptual framework at the end of the review, in order to examine the applicability of the framework to LLMIC contexts.

In fact, the findings do not suggest that the conceptual framework is *inapplicable* to lower-income contexts, as we found no consistent evidence indicating that any of the pathways to impact do not function as outlined in the diagram. The review has, however, exposed some areas of inconsistency in the literature, as well as a significant lack of evidence around certain pathways. Rather than creating an entirely new diagram, we therefore elected to represent the findings of the review by colour-coding the initial diagram, highlighting both the major findings proceeding from the review and the areas requiring additional research.

The revised conceptual framework is presented as Figure 2, below. Consistent evidence of impact is represented by a green arrow, while inconsistent evidence is represented in yellow. The pathways to impact around which there is limited evidence (that is, fewer than 20 studies) are highlighted with dashed (as opposed to solid) arrows on the diagram.

Figure 2: Revised conceptual framework

As discussed in the previous section, it was not possible to investigate regional and national differences in the functioning of these pathways to impact. Rather, the revised framework proposes a general theory of change that can be used to frame thinking around TE in multiple contexts. Our reliance on literature from a wide range of countries allows us to draw some conclusions across the full range of LLMICs. However, it is clear that local, national and regional contexts do influence—and even determine—the nature and effectiveness of TE and, consequently, its impact on society. A full understanding of the potential of TE to impact development, therefore, requires detailed attention to local, national and regional contexts. The two brief national case studies that we presented in Appendix 7 demonstrate the utility of examining the interactions between specific contextual conditions and evidence of impact in particular contexts. The barriers to impact described in Section 6 seem to play a particularly important role. Teaching quality, for example, determines the extent to which the productivity of graduates is enhanced, while academic freedom influences the ability of universities to develop original research. To a large extent, it is these limiting factors that drive how well (or how poorly) a given country demonstrates the theory of change outlined in the diagram.

Further refinement of the diagram might be possible through the investigation of two important relationships that could not be adequately analysed within the current review. First, we were limited in our ability to investigate the relationship between various inputs

to TE and development, given the severe lack of studies following the entire causal pathway from inputs to impact. The majority of the included studies investigate the relationship between TE outputs and outcomes (for example, the large number of studies linking graduation from TE with earnings). During the review process, we also identified a large number of studies that document the effect of particular inputs on the functioning of TE systems (for example, access policies that aim to change the composition of the student body). However, none of them could be included, as they do not investigate how these changes in inputs impact society. This prevents us from drawing any conclusions around how particular TE interventions or models of TE provision (for example, public versus private) differentially impact development in LLMICs. Second, we were somewhat restricted by our need to focus on studies demonstrating actual development impact. The five outcomes of TE considered during synthesis constitute the penultimate column in the conceptual diagram, with development (both economic and non-economic) then emerging from these intermediate goals. Although we focused on these outcomes because of their likely impact on development, it is important to recognise that some of these outcomes can, in fact, also be seen as ends in themselves. For example, democratic institutions and an active and participatory citizenry can be seen as constitutive of development, as well as being conducive to improvements in social welfare. However, as our search strategy emphasised studies considering developmental impact, we may have missed studies that only consider the impact of TE on these proximal outcomes. Analysis of this body of evidence might help to clarify some of the pathways to impact on these intermediate outcomes, independent of the relationship between such outcomes and broader development indicators.

8.3 Reflections on the scope of the review

As a result of the renewed interest in TE in recent years, there are a number of important policy questions related to TE investment and provision that feature prominently in the literature on TE and development. Although investigation of these questions was largely beyond the remit of this review, our findings can provide some important insights for policy-makers engaged in decision-making around these issues.

First, there continues to be significant interest in the long-standing debate around the relative importance of investment in different levels of education. As discussed throughout this report, there is significant disagreement around the relative return on investment in primary, secondary and higher education. This review cannot provide a definitive answer to this question. It does, however, highlight the danger of investing in one or two levels of education *at the expense of the others*. It seems clear that the reduction in funding of TE systems in recent decades has had a negative effect on the quality (and, therefore, impact) of TE in many LLMICs. Although the findings of this review suggest that investment in TE is likely to have a positive impact on a wide range of development outcomes, investment in TE at the expense of other levels of education is unlikely to yield positive results. Keller has asserted that, 'Education stages affect one another—mainly, lower stages benefit higher—e.g., primary enrolment rates and expenditures per pupil therein highly significantly increase secondary enrolment rates, which in turn and with expenditures thereon raise college enrolment rates' (p 29). We agree with this analysis and emphasise that investment in the full continuum of education appears to be necessary for development. Although analysis of evidence from individual upper-middle-income countries is beyond the scope of this review, the theoretical

literature suggests that many upper-middle-income countries have benefited from investment in the full range of educational provision.

Second, there is substantial debate around which types of TE provision, and which interventions, are likely to have the greatest development impact. Although there is considerable literature on contemporary changes in TE systems (that is, the expansion of the private sector, including for-profit institutions; the commercialisation of public institutions; the establishment of branch campuses; and the development of distance-education models, including massive open online courses [MOOCs]), very few studies show how these changes have impacted development. Very often, these studies will show the impact of these changes on the university itself (see, for example, Wangenge-Ouma 2007), but not the consequent impact on society. We also found very few studies that consider the relative benefits of academic or vocational provision, or of home provision versus sending students to study overseas. As discussed in Section 7, we had similar difficulty in identifying studies showing the differential impact of externally funded interventions on development. The limited evidence in this area is related to the lack of studies connecting inputs to impact (discussed above). As a result of this limited evidence base, we have only limited knowledge of the types of TE provision that bring the greatest impact (for example, the forms of pedagogy and curriculum structure that are most effective in enhancing productivity in the workplace or civic participation).

8.4 Research gaps and recommendations

Beyond the general lack of research in this domain, there are a number of critical gaps that emerge from this review.

First, there is a need for additional macro-level analysis of the impact of TE on a range of development outcomes. In order for such research to be conducted, improvements in data systems are needed. There is a particular need for expanded administrative data on enrolments and for labour surveys within LLMIC contexts. Many of the most frequently used data sources are also now dated, so a new round of investigation is needed to capture recent trends at macro level.

Second, there is a clear need for additional research considering the non-market benefits of TE. This is essential in order to gauge the full impact of TE on the broad range of human-development outcomes, including health, democracy, gender equality and the environment. It is interesting to note that, of the 48 studies excluded during quality appraisal, many were written by local research teams and focus on such non-market benefits. While a systematic comparison of studies conducted by external researchers and by local teams was not carried out across the whole review, the indications are that the latter grouping, although sometimes facing methodological and resource challenges, presents a range of particularly original and pertinent research questions. Southern perspectives on TE are, therefore, important in acknowledging the diverse forms of impact and in illuminating the complexity of context-specific barriers and facilitators to impact. Support for Southern researchers would seem to be an important area of investment in this domain.

Three pillars of teaching, research and service guided the review for this report. There is evidence around the impact of teaching, but the evidence base related to research and

service is extremely limited. These three pillars do not work in isolation towards achieving full TE impact on development. The manner in which they interact, and the conditions that promote any one or all of the pillars, warrant further research investment. In particular, there is a critical lack of research considering the impact of universities on local communities through service. Only two out of 147 studies included in the review addressed service specifically (although there were a further 23 that addressed multiple functions of the institution). More research is needed into both specific outreach, extension and knowledge-transfer programmes run by universities and the use of university services by local communities (for example, healthcare and other amenities). This is also an area in which support for local researchers may play a role, as both of the service titles and more than half of the titles considering a combination of functions were written by local researchers and were excluded during quality appraisal.

There is also limited evidence of how particular conditions may affect impact. The apparent lack of focus on some of the limiting factors mentioned earlier in this report may be related to the pressures of short funding cycles, as factors such as quality require both long-term interventions and time-intensive evaluations. It is also likely that the privileging of certain types of research design within the development community has limited the ability of organisations to address some of the more entrenched limiting factors affecting TEIs.

As discussed in Section 7, there is also a lack of research assessing the development impact of TE interventions. In some respects, this lack of focus on development outcomes is likely to be a casualty of the pressure placed on organisations to demonstrate impact within short time periods. Many of the intended outcomes of TE interventions require a long implementation timeframe and evaluation period. There is also a need for more external evaluation of TE interventions. Many of the studies referenced in Section 7 were written by representatives of the organisations sponsoring the interventions in question. Although participant observation can provide interesting insight into the process of implementing certain intervention models, the vested interest in demonstrating effectiveness can limit the utility of such assessments. External evaluation would also provide an opportunity to compare the effectiveness of different models in achieving particular intervention outcomes. The lack of comparative studies evident in our sample suggests that this is an under-researched area. The limited conclusions that could be drawn in this review regarding the impact of interventions also indicate the need for a more targeted analysis of the existing literature on interventions. A separate review of research findings related to interventions could provide additional insight into the effectiveness of varying models within different geographic contexts.

Finally, there appears to be an over-emphasis within the literature on the cost-effectiveness of investment in particular levels of education (in comparison with other levels). In contrast, there is very little research considering the relative cost-effectiveness of investing in particular kinds of TE provision or in funding particular TE interventions. Further research in this domain may provide additional insight into the apparent mismatch observed between barriers to impact and intervention objectives in LLMICs.

Given the multiple research gaps in the field, various recommendations for research agendas emerge from this review. In addition to the general need for more research

considering the impact of TE on development, we suggest the following as the most critical research needs within this domain:

- Further macro-level studies, using updated datasets and acknowledging time lag of impact
- Research gauging the non-market benefits of TE
- Further analysis of the link between TE and poverty reduction
- Further assessment of the impact of the research and service functions of TEIs, as well as investigation of how the three pillars interact to impact development
- Studies following the process from inputs all the way to impact
- Investigation of how limiting factors in particular contexts affect impact
- Research into the effectiveness (and cost-effectiveness) of varying models of external support to TE

There has been a resurgence of interest in TE in recent years. The growing recognition that TE is likely to have played an important role in the development trajectories of many formerly low-income countries, such as South Korea, provides LLMICs with an opportunity to revitalise their struggling TE sub-sectors and break down many of the barriers to impact currently limiting TE's transformative potential in such contexts. Research can play a critical role in this process, by identifying the conditions under which TE can have the greatest impact on local, national and regional development and assessing the effectiveness (and cost-effectiveness) of interventions that aim to address such factors. Additional research is also required to further unpack the various ways in which TE impacts development in LLMICs, as it is clear that the prevailing models in the literature may not fully explain the complexities of this interaction.

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Section 3: Supporting literature

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Appendices

Appendix 1: Detailed methodology

The review was organised in five distinct phases:

1. **Planning:** Elaboration of the conceptual framework and articulation of the search strategy
2. **Searching:** Identification of relevant literature
3. **Screening and coding:** Investigation of the scope and relevance of identified literature, resulting in a reduced list of studies, and simultaneous descriptive coding of the included studies
4. **Quality appraisal:** Analysis of the quality of all included studies, resulting in a further-reduced list of studies for synthesis
5. **Synthesis:** Analysis of the evidence from the included studies

1. Planning

The review process began with the articulation of a conceptual framework to guide the study (outlined in Section 2 of this report). Definitions of key terms were also clarified to allow for the construction of an overarching search strategy. These definitions are described in detail in sub-section 1.2 of this report.

2. Searching for evidence

Once our search strategy was confirmed, we used two methods to identify potentially relevant literature:

1. Identification of existing systematic reviews in related areas that might yield relevant references for inclusion in the review
2. Targeted searches in a wide range of bibliographic databases and websites that were likely to contain information relevant to the review

2.1 Reference checking

Existing systematic reviews were first identified through the 3ie Database of Systematic Reviews and the online Campbell Collaboration Library. The reference lists for seven reviews were consulted, yielding 100 titles for inclusion in the study²⁰.

2.2 Database and website searches

Database and website searches were then conducted with the support of the EPPI-Centre at the Institute of Education. The search strategy used for both the bibliographic databases and the websites was very broad, incorporating a number of controlled terms for TE and for development. The breadth was deemed necessary in order to capture the range of literature that might be relevant to the topic under study. As each database has a slightly different list of controlled terms, the search strategy was not absolutely standard across resources. A few example search strategies are included for reference as Appendix 2. Searches were limited by date and geographic context (following the

²⁰ These reviews are included in the references section.

inclusion/exclusion criteria outlined in the next section), but were not restricted by language or type of literature.

The following websites and bibliographic databases were consulted during the course of the review:

Bibliographic databases

Education databases

- British Education Index
- ERIC

Other social science databases

- Worldwide Political Science Abstracts
- Econlit
- ASSIA
- International Bibliography of Social Sciences
- Social Science Citation Index

Databases focusing on development issues

- British Library of Development Studies
- Global Health

Regionally specific databases

- African Women Bibliographic Database
- Africa Periodical Literature

Websites

- 3ie Database of Impact Evaluations
- International Development Research Centre
- Research for Development (DFID)
- UNESCDOC
- JOLIS (World Bank and IMF literature)
- Labordoc
- African Journals Online
- Asia Journals Online
- Latin America Journals Online
- Association of African Universities
- International Association of Universities
- Association of Commonwealth Universities
- CODESRIA (Council for the Development of Social Science in Africa)
- HERANA (Higher Education Research & Advocacy Network in Africa)
- CHET (Centre for Higher Education Transformation)
- Association for the Development of Education in Africa
- South East Asia Index

These resources were selected because they were likely to yield evidence that was relevant to the central research question, while also representing a wide range of disciplinary perspectives. We also made an explicit effort to include ‘grey’ literature (non-peer-reviewed literature, typically published by international agencies and organisations) and to identify academic literature published within LLMICs.

In the initial protocol for this study, the International Association for the Evaluation of Educational Achievement, Third World Network Papers and Reports, Policy pointers and CREATE were mentioned as potential sources, but these websites were found to yield no titles related to TE in LLMICs. We had also intended to consult the Database of Education Research, IDEAS RePEc, Social Science Research Network and the Global Development Network. However, these four websites were ultimately removed from the search strategy. As these four websites have a substantial amount of overlap with the core list in terms of disciplinary and contextual focus, we determined that their inclusion would generate very few additional titles, while consuming a significant amount of human resources. Similarly, the decision was made not to incorporate Google and Google Scholar and not to attempt to conduct a hand search of edited volumes or individual journal archives, given the large number of titles yielded through the initial search (>12,000).

Members of the expert panel were, however, given the opportunity to suggest titles that we may have missed through our initial search.

2.3 Restricting the scope of the review

In total, 12,213 titles were identified as potentially relevant for inclusion in the review. Of these, 11,863 were identified through database searches, 242 through website searches and 100 through reference checking of existing reviews (as discussed above). The remaining eight titles were additional recommendations made by members of the study's expert panel²¹. All 12,213 titles were imported in EPPI-Reviewer, a specialist software package designed to assist with information management in systematic reviews (Brunton and Thomas 2012). A duplicate check was then conducted within EPPI-Reviewer, which removed 338 titles as duplicates.

Given the very large volume of potentially relevant literature and the need to maintain a tight focus in the study, the decision was made to alter the scope of the review by focusing exclusively on low-income and lower-middle-income countries, excluding upper-middle-income countries. We also elected to exclude low- or lower-middle-income countries located in Europe or the former Soviet Union, given the distinct histories of countries in these regions. Using the World Bank classification of countries, we ran an initial automated search within EPPI-Reviewer to identify titles and/or abstracts that explicitly mentioned the names of low or lower-middle-income countries; the remaining studies were excluded from the review. The remaining **6,677 titles** were retained for consideration during the screening and coding phase of the study.

3. Screening and coding

There were two stages to the screening and coding phase of the review:

1. Screening on title and abstract
2. Screening on full text

3.1 Screening on title and abstract

All 6,677 titles were first screened on title and abstract. During this stage, the title and

²¹ A detailed breakdown is included as Appendix C.

abstract of each study being considered for inclusion was reviewed and assessed against the study's inclusion/exclusion criteria. In order to proceed to the next stage in the process, each study had to meet all of the following criteria:

- Date: Published since 1990
- Language: Written in English²²
- Geographic context: Focused on at least one low-income or lower-middle-income country (not including countries in Europe or the former Soviet Union)²³
- Sector context: Focused on some aspect of TE (as defined in Section 1.2). Studies considering 'post-primary' education, in which the relative impact of secondary versus tertiary education cannot be disaggregated, were excluded from the review.
- Type of literature: Published source likely to include some element of peer review or adherence to professional standards of research (such as journal articles, books, conference papers or institutional grey literature). Unpublished sources, such as theses/dissertations, meeting minutes and newspaper articles, were excluded from the review.
- Type of study: Empirical research (using quantitative or qualitative methods) examining at least one of the various pathways to impact included in the review's conceptual framework. Purely descriptive or normative sources, such as statements of policy, were excluded from the review. Empirical studies had to attempt to investigate *impact on development* in order to be included. Studies focusing exclusively on inputs (such as financing arrangements, institutional-governance structures, faculty numbers and/or qualifications, or TE policies) or experiences within TEIs were not included, unless they analysed the effect of such inputs or experiences on development outcomes.

A moderation exercise was conducted at the start of this stage to discuss decisions of individual team members, and resolve any inconsistencies.

At the end of the first screening phase, 5,286 titles flagged for exclusion were removed from the study²⁴. The remaining 862 titles were moved forward to the second stage of screening.

3.2 Screening on full text

The full-text versions of the remaining titles were located either online, in one of the Bloomsbury libraries (IOE, SOAS or Senate House) or in the British Library. Of these titles, the full text of 194 could not be found and had to be excluded from the review. The remaining 668 were screened at full text by members of the research team.

As during the title and abstract stage, each title was assessed on full-text screening against the inclusion/exclusion criteria. During this stage, any study found to meet all of the inclusion criteria was coded on a number of descriptive variables, including geographic context, type of literature, type of study, and conceptual theme. A second moderation exercise was organised with all participating team members, in which five studies were coded and discussed in order to highlight any potential areas of disagreement. At the end

²² Studies written in other languages were not included, on account of time and resource constraints and the linguistic ability of the team members. French or Spanish language studies were initially included in the database search and title and abstract screening, but were subsequently excluded.

²³ A full list of included and excluded countries can be found in Appendix D.

²⁴ An additional 529 titles were coded as 'assumptions' or 'interventions' titles and set aside for consideration at the end of the review process.

of the full-text-screening stage, an additional 430 studies were excluded from the review, leaving a final list of 147 studies for quality appraisal²⁵.

4. Quality appraisal

Included studies were then screened for robustness of evidence and methodological rigour, using the standards set out by the DFID 'How to note' on 'Assessing the strength of evidence' (DFID 2013). The Guidelines for the REPOrting of primary empirical research Studies in Education (the REPOSE Guidelines) also informed the quality standards used when assessing the evidence included in the remaining studies (Newman and Elbourne 2005).

During the quality-appraisal process, each study was analysed in terms of its transparency, appropriateness, validity and reliability. A list of questions was prepared to guide the assessment of the studies (included as Appendix 5). Any study not fulfilling all of these criteria was excluded from the final list of studies for synthesis. The four team members involved in the quality-appraisal stage first coded a number of studies in pairs in order to establish consistency in application of the quality standards.

Those studies found to meet the quality standards were coded on a number of additional descriptive variables (including data-collection method and data-analysis method), in order to capture the diversity of method and levels of robustness of the resulting evidence. In total, **99 studies** were retained for synthesis.

5. Data synthesis

Meta-synthesis was then used to examine the degree to which the body of evidence reflects the various pathways to impact outlined in our conceptual framework. Analysis of the impact of TE in LLMICs was conducted using the principles of framework synthesis (Thomas et al. 2012), a method that allows for the identification of key issues and recurrent themes among studies. This method has been found to be suitable for reviews of studies with diverse designs (for example, experimental designs, economic analyses and qualitative studies)²⁶. Studies were first grouped thematically. The review team then summarised the literature within each thematic group, outlining the geographic context, study design, major findings, and level of robustness of each individual study. The summarised findings were then compared and contrasted, and conclusions were drawn within each body of evidence. The overall findings were then mapped onto the existing conceptual framework, allowing us to identify areas of non-applicability and refine our initial understanding of how TE impacts development in LMICs.

6. Quality control

Although it was not possible to complete double-coding during the review process, the team was able to complete a back-check of the excluded titles in order to verify consistency in coding between team members. During the screening process, it became clear that most disagreements arose around the definition of 'empirical' versus 'theoretical' literature and in the determination of whether or not a study included evidence of impact on development. Team members did not have any trouble applying more concrete exclusion criteria, such as date and geographic context. We therefore

²⁵ An additional 91 titles were coded as 'assumptions' or 'interventions' titles during full-text screening and set aside for consideration at the end of the review process.

²⁶ Although there was a significant number of quantitative studies, it was not possible to do any meta-analysis of the results, as the studies relied on drastically different methodologies and, in many instances, used non-comparable datasets.

elected to back-check 10% of the titles initially excluded on the grounds of being 'non-empirical' or 'not demonstrating impact'. This test yielded a 90% reliability rate between coders.

The use of EPPI-Reviewer software throughout the study has also established a record that can be used as a reference for future studies. EPPI-Reviewer maintains a detailed search log of every decision made during the screening and coding phases, allowing for future replication of the review process.

Appendix 2: Test search for review

Database: ERIC search
Database platform: Proquest
Date: 19/3/2013
Results: 3,289 records
SU = controlled vocabulary
ab = abstract
ti = title

S1: SU.EXACT('Social Justice') OR SU.EXACT('Knowledge Economy') OR SU.EXACT('Economic Change') OR SU.EXACT('Social Capital') OR SU.EXACT('Skill Development') OR SU.EXACT('Community Development') OR SU.EXACT('Labor Force') OR SU.EXACT('Community Planning') OR SU.EXACT('Community Benefits') OR SU.EXACT('Living Standards') OR SU.EXACT('Capacity Building') OR SU.EXACT('Job Development') OR SU.EXACT('Labor Economics') OR SU.EXACT('Citizen Participation') OR SU.EXACT('Economic Development') OR SU.EXACT('Technological Advancement') OR SU.EXACT('Community Change') OR SU.EXACT('Rural Development') OR SU.EXACT('Economic Impact') OR SU.EXACT('Employment Patterns') OR SU.EXACT('Labor Market') OR SU.EXACT('Labor Needs') OR SU.EXACT('Macroeconomics') OR SU.EXACT('Developmental Programs') OR SU.EXACT('Sustainable Development') OR SU.EXACT('Labor') OR SU.EXACT('Labor Supply') OR SU.EXACT('Labor Force Development') OR SU.EXACT('Unemployment') OR SU.EXACT('Supply and Demand') OR SU.EXACT('Social Change') OR SU.EXACT('Quality of Life') OR SU.EXACT('Economic Research') OR SU.EXACT('Economic Progress') OR SU.EXACT('Underemployment') OR SU.EXACT('Employment') OR SU.EXACT('Human Capital') OR SU.EXACT('Economics') OR SU.EXACT('Futures (of Society)') OR SU.EXACT('Labor Utilization') OR SU.EXACT('Community Responsibility') OR SU.EXACT('Labor Turnover') OR SU.EXACT('Technology Transfer')

S2 ti('Economic growth' OR 'Human development' OR 'Social justice' OR 'Economic returns' OR 'Investment returns' OR 'Human resources' OR 'Social change' OR 'Economic change' OR 'Social cohesion' OR 'Agricultural development' OR 'Labour market' OR 'Labour market' OR 'labour force' OR 'labour productivity' OR 'Labor market' OR 'Labor market' OR 'labor force' OR 'labor productivity' OR 'Manpower development' OR 'employment' OR 'Earnings' OR 'Wages' OR 'income level' OR 'income distribution' OR 'income levels' OR Mobility OR Competitiveness OR 'Social Development' OR 'National development' OR 'Economic development' OR ((increas* OR chang* OR reduc* OR raise* OR decreas*) NEAR/2 (GDP)) OR ((increas* OR chang* OR reduc* OR raise* OR decreas*) NEAR/2 ('Gross Domestic Product')) OR returns OR (rate* NEAR/2 return*) OR 'institutional growth')

S3 ti('highly educated' OR 'levels of education' OR 'educational planning' OR (tertiary NEAR/2 education) OR 'higher education' OR 'Post secondary education' OR 'Post secondary colleges' OR 'Technical colleges' OR 'Technical college' OR (Polytechnic* NEAR/2 education) OR 'Post-graduate education' OR 'Postgraduate education' OR 'Post graduate education' OR (University NEAR/2 education) OR ('tertiary enrolment') OR ('tertiary enrolments') OR 'tertiary distance education' OR ('tertiary level' AND education) OR ('tertiary level' AND educational) OR 'tertiary training' OR 'tertiary institution' OR 'tertiary institutions' OR (Universities NEAR/2 education) OR 'postdoctoral education' OR 'postsecondary education' OR 'postsecondary college' OR 'postsecondary colleges' OR 'post secondary college' OR ('tertiary level' NEAR/2 (education OR college OR colleges)) OR 'undergraduate education' OR 'undergraduate study' OR 'technical education' OR TVET OR 'vocational education' OR 'degree-level education' OR ('degree

accredited' NEAR/2 (college* OR institution OR institutions)) OR 'third level institution' OR 'third level institutions' OR 'third level education' OR 'third level college' OR 'third level colleges' OR 'satellite university' OR 'satellite universities' OR 'advanced education') OR ab('highly educated' OR 'levels of education' OR 'educational planning' OR (tertiary NEAR/2 education) OR 'higher education' OR 'Post secondary education' OR 'Post secondary colleges' OR 'Technical colleges' OR 'Technical college' OR (Polytechnic* NEAR/2 education) OR 'Post-graduate education' OR 'Postgraduate education' OR 'Post graduate education' OR (University NEAR/2 education) OR ('tertiary enrolment') OR ('tertiary enrolments') OR 'tertiary distance education' OR ('tertiary level' AND education) OR ('tertiary level' AND educational) OR 'tertiary training' OR 'tertiary institution' OR 'tertiary institutions' OR (Universities NEAR/2 education) OR 'postdoctoral education' OR 'postsecondary education' OR 'postsecondary college' OR 'postsecondary colleges' OR 'post secondary college' OR ('tertiary level' NEAR/2 (education OR college OR colleges)) OR 'undergraduate education' OR 'undergraduate study' OR 'technical education' OR TVET OR 'vocational education' OR 'degree-level education' OR ('degree accredited' NEAR/2 (college* OR institution OR institutions)) OR 'third level institution' OR 'third level institutions' OR 'third level education' OR 'third level college' OR 'third level colleges' OR 'satellite university' OR 'satellite universities' OR 'advanced education') OR ab('Two-year Colleges' OR 'Community Colleges' OR 'Technical Institutes' OR 'Two-year College' OR 'Community College') OR ti('Two-year Colleges' OR 'Community Colleges' OR 'Technical Institutes' OR 'Two-year College' OR 'Community College')

S4 (SU.EXACT('Undergraduate Study') OR SU.EXACT('Postdoctoral Education') OR SU.EXACT('Higher Education') OR SU.EXACT('Postsecondary Education') OR SU.EXACT('Graduate Study')) OR (SU.EXACT('Vocational Schools') OR SU.EXACT('Technical Education') OR SU.EXACT('Technical Institutes') OR SU.EXACT('Community Colleges') OR SU.EXACT('Universities') OR SU.EXACT('Agricultural Colleges') OR SU.EXACT('Colleges') OR SU.EXACT('Two Year Colleges') OR SU.EXACT('Vocational Education') OR SU.EXACT('Noncampus Colleges'))

S5 SU.EXACT('Developing Nations') OR SU.EXACT('Slums')

S6 ab(Africa or Asia or Caribbean or 'West Indies' or 'South America' or 'Latin America' or 'Central America' or ((developing OR 'low income' OR 'less developed' OR 'lesser developed' OR 'middle income' OR 'under developed' OR 'underdeveloped' OR 'low and middle income' OR 'lower income') NEAR/1 (countr* OR nation OR nations OR world)) or ((African OR Asian OR 'South American' OR 'Central American' OR 'West Indian') NEAR/1 (nations OR countries OR economy OR economies)) or ((underserved OR 'under served' OR deprived OR poor) NEAR/1 (countr* OR nation OR nations OR world)) OR ((LMIC OR LMICS OR 'third world') NEAR/3 (countr* OR nation OR nations))) OR ti(Africa or Asia or Caribbean or 'West Indies' or 'South America' or 'Latin America' or 'Central America' or ((developing OR 'low income' OR 'less developed' OR 'lesser developed' OR 'middle income' OR 'under developed' OR 'underdeveloped' OR 'low and middle income' OR 'lower income') NEAR/1 (countr* OR nation OR nations OR world)) or ((African OR Asian OR 'South American' OR 'Central American' OR 'West Indian') NEAR/1 (nations OR countries OR economy OR economies)) or ((underserved OR 'under served' OR deprived OR poor) NEAR/1 (countr* OR nation OR nations OR world)) OR ((LMIC OR LMICS OR 'third world') NEAR/3 (countr* OR nation OR nations)))

S7 ab(Afghanistan OR Albania OR Algeria OR Angola OR Antigua OR Barbuda OR Argentina OR Armenia OR Armenian OR Aruba OR Azerbaijan OR Bahrain OR Bangladesh OR Barbados OR Benin OR Byelarus OR Byelorussian OR Belarus OR Belorussian OR Belorussia OR Belize OR Bhutan OR Bolivia OR Bosnia OR Herzegovina OR Hercegovina OR Botswana OR Brazil OR Bulgaria OR 'Burkina Faso' OR 'Burkina Fasso' OR 'Upper Volta' OR Burundi OR Urundi

OR Cambodia OR 'Khmer Republic' OR Kampuchea OR Cameroon OR Camerons OR
Cameron OR Camerons OR 'Cape Verde' OR 'Central African Republic' OR Chad OR Chile
OR China OR Colombia OR Comoros OR 'Comoro Islands' OR Comores OR Mayotte OR Congo
OR Zaire OR 'Costa Rica' OR 'Cote d'Ivoire' OR 'Ivory Coast' OR Croatia OR Cuba OR
Cyprus OR Czechoslovakia OR 'Czech Republic' OR Slovakia OR 'Slovak Republic' OR
Djibouti OR 'French Somaliland' OR Dominica OR 'Dominican Republic' OR 'East Timor' OR
'East Timur' OR 'Timor Leste' OR Ecuador OR Egypt OR 'United Arab Republic' OR 'El
Salvador' OR Eritrea OR Estonia OR Ethiopia OR Fiji OR Gabon OR 'Gabonese Republic' OR
Gambia OR Gaza OR 'Georgia Republic' OR 'Georgian Republic' OR Ghana OR 'Gold Coast'
OR Greece OR Grenada OR Guatemala OR Guinea OR Guam OR Guiana OR Guyana OR Haiti
OR Honduras OR Hungary OR India OR Maldives OR Indonesia OR Iran OR Iraq OR Jamaica
OR Jordan OR Kazakhstan OR Kazakh OR Kenya OR Kiribati OR Korea OR Kosovo OR
Kyrgyzstan OR Kirghizia OR 'Kyrgyz Republic' OR Kirghiz OR Kirgizstan OR 'Lao PDR' OR
Laos OR Latvia OR Lebanon OR Lesotho OR Basutoland OR Liberia OR Libya OR Lithuania
OR Macedonia OR Madagascar OR 'Malagasy Republic' OR Malaysia OR Malaya OR Malay OR
Sabah OR Sarawak OR Malawi OR Nyasaland OR Mali OR Malta OR 'Marshall Islands' OR
Mauritania OR Mauritius OR 'Agalega Islands' OR Mexico OR Micronesia OR 'Middle East' OR
Moldova OR Moldovia OR Moldovian OR Mongolia OR Montenegro OR Morocco OR Ifni OR
Mozambique OR Myanmar OR Myanma OR Burma OR Namibia OR Nepal OR 'Antilles' OR
'New Caledonia' OR Nicaragua OR Niger OR Nigeria OR 'Northern Mariana Islands' OR
Oman OR Muscat OR Pakistan OR Palau OR Palestine OR Panama OR Paraguay OR Peru OR
Philippines OR Philipines OR Phillipines OR Phillippines OR Poland OR Portugal OR 'Puerto
Rico' OR Romania OR Rumania OR Roumania OR Russia OR Russian OR Rwanda OR Ruanda
OR 'Saint Kitts' OR 'St Kitts' OR Nevis OR 'Saint Lucia' OR 'St Lucia' OR 'Saint Vincent' OR
'St Vincent' OR Grenadines OR Samoa OR 'Samoa Islands' OR 'Navigator Island' OR
'Navigator Islands' OR 'Sao Tome' OR 'Saudi Arabia' OR Senegal OR Serbia OR Montenegro
OR Seychelles OR 'Sierra Leone' OR Slovenia OR 'Sri Lanka' OR Ceylon OR 'Solomon
Islands' OR Somalia OR Sudan OR Suriname OR Surinam OR Swaziland OR Syria OR
Tajikistan OR Tadjhikistan OR Tadjikistan OR Tadjhik OR Tanzania OR Thailand OR Togo
OR 'Togolese Republic' OR Tonga OR Trinidad OR Tobago OR Tunisia OR Turkey OR
Turkmenistan OR Turkmen OR Uganda OR Ukraine OR Uruguay OR USSR OR Soviet Union OR
Union of 'Soviet Socialist Republics' OR Uzbekistan OR Uzbek OR Vanuatu OR New
Hebrides OR Venezuela OR Vietnam OR 'Viet Nam' OR 'West Bank' OR Yemen OR
Yugoslavia OR Zambia OR Zimbabwe OR Rhodesia OR 'Jamahiriya' OR 'Jamahiryria' OR
'Libia' OR 'Mocambique' OR 'Principe' OR 'Syrian Arab' OR 'Indian Ocean Islands' OR
Melanesia OR 'Western Sahara' OR 'Zanzibar OR ' Togoland OR 'Tanganika' OR 'East
Bengal' OR 'Kampuchea' OR 'Cabo Verde') OR ti(Afghanistan OR Albania OR Algeria OR
Angola OR Antigua OR Barbuda OR Argentina OR Armenia OR Armenian OR Aruba OR
Azerbaijan OR Bahrain OR Bangladesh OR Barbados OR Benin OR Byelarus OR Byelorussian
OR Belarus OR Belorussian OR Belorussia OR Belize OR Bhutan OR Bolivia OR Bosnia OR
Herzegovina OR Hercegovina OR Botswana OR Brazil OR Bulgaria OR 'Burkina Faso' OR
'Burkina Fasso' OR 'Upper Volta' OR Burundi OR Urundi OR Cambodia OR 'Khmer Republic'
OR Kampuchea OR Cameroon OR Camerons OR Cameron OR Camerons OR 'Cape Verde'
OR 'Central African Republic' OR Chad OR Chile OR China OR Colombia OR Comoros OR
'Comoro Islands' OR Comores OR Mayotte OR Congo OR Zaire OR 'Costa Rica' OR 'Cote
d'Ivoire' OR 'Ivory Coast' OR Croatia OR Cuba OR Cyprus OR Czechoslovakia OR 'Czech
Republic' OR Slovakia OR 'Slovak Republic' OR Djibouti OR 'French Somaliland' OR
Dominica OR 'Dominican Republic' OR 'East Timor' OR 'East Timur' OR 'Timor Leste' OR
Ecuador OR Egypt OR 'United Arab Republic' OR 'El Salvador' OR Eritrea OR Estonia OR
Ethiopia OR Fiji OR Gabon OR 'Gabonese Republic' OR Gambia OR Gaza OR 'Georgia
Republic' OR 'Georgian Republic' OR Ghana OR 'Gold Coast' OR Greece OR Grenada OR
Guatemala OR Guinea OR Guam OR Guiana OR Guyana OR Haiti OR Honduras OR Hungary
OR India OR Maldives OR Indonesia OR Iran OR Iraq OR Jamaica OR Jordan OR Kazakhstan
OR Kazakh OR Kenya OR Kiribati OR Korea OR Kosovo OR Kyrgyzstan OR Kirghizia OR

'Kyrgyz Republic' OR Kirghiz OR Kirgizstan OR 'Lao PDR' OR Laos OR Latvia OR Lebanon OR Lesotho OR Basutoland OR Liberia OR Libya OR Lithuania OR Macedonia OR Madagascar OR 'Malagasy Republic' OR Malaysia OR Malaya OR Malay OR Sabah OR Sarawak OR Malawi OR Nyasaland OR Mali OR Malta OR 'Marshall Islands' OR Mauritania OR Mauritius OR 'Agalega Islands' OR Mexico OR Micronesia OR 'Middle East' OR Moldova OR Moldavia OR Moldovian OR Mongolia OR Montenegro OR Morocco OR Ifni OR Mozambique OR Myanmar OR Myanma OR Burma OR Namibia OR Nepal OR 'Antilles' OR 'New Caledonia' OR Nicaragua OR Niger OR Nigeria OR 'Northern Mariana Islands' OR Oman OR Muscat OR Pakistan OR Palau OR Palestine OR Panama OR Paraguay OR Peru OR Philippines OR Philipines OR Phillipines OR Phillippines OR Poland OR Portugal OR 'Puerto Rico' OR Romania OR Rumania OR Roumania OR Russia OR Russian OR Rwanda OR Ruanda OR 'Saint Kitts' OR 'St Kitts' OR Nevis OR 'Saint Lucia' OR 'St Lucia' OR 'Saint Vincent' OR 'St Vincent' OR Grenadines OR Samoa OR 'Samoa Islands' OR 'Navigator Island' OR 'Navigator Islands' OR 'Sao Tome' OR 'Saudi Arabia' OR Senegal OR Serbia OR Montenegro OR Seychelles OR 'Sierra Leone' OR Slovenia OR 'Sri Lanka' OR Ceylon OR 'Solomon Islands' OR Somalia OR Sudan OR Suriname OR Surinam OR Swaziland OR Syria OR Tajikistan OR Tadjhikistan OR Tadjikistan OR Tadjhik OR Tanzania OR Thailand OR Togo OR 'Togolese Republic' OR Tonga OR Trinidad OR Tobago OR Tunisia OR Turkey OR Turkmenistan OR Turkmen OR Uganda OR Ukraine OR Uruguay OR USSR OR Soviet Union OR Union of 'Soviet Socialist Republics' OR Uzbekistan OR Uzbek OR Vanuatu OR New Hebrides OR Venezuela OR Vietnam OR 'Viet Nam' OR 'West Bank' OR Yemen OR Yugoslavia OR Zambia OR Zimbabwe OR Rhodesia OR 'Jamahiriya' OR 'Jamahiryria' OR 'Libia' OR 'Mocambique' OR 'Principe' OR 'Syrian Arab' OR 'Indian Ocean Islands' OR Melanesia OR 'Western Sahara' OR 'Zanzibar OR ' Togoland OR 'Tanganika' OR 'East Bengal' OR 'Kampuchea' OR 'Cabo Verde')

S8 S1 OR S2

S9 S3 OR S4

S10 S5 OR S6 OR S7

S11 (S8 AND S9 AND S10) AND yr (1990-2019)

Appendix 3: Breakdown of uploaded titles

Databases*

Database	Records	Duplicates	Final number imported
African Periodical Lit	69	3	66
African Women	122	1	121
ASSIA	745	49	696
British Education Index	998	132	866
BLDS	617	1	616
EconLit	435	14	421
ERIC	4,104	35	4,069
Global Health	159	0	159
IBSS	1,269	527	742
SSCI	2,704	213	2,491
WPSA	1,665	49	1,616
Totals	12,887	1,024	11,863

*Did not include Australian Education Index as output function did not allow titles to download

Existing Reviews

Existing systematic review	Duplicates	Number Imported
Petrosino <i>et al.</i> (2012)		2
Hargreaves and Boler (2006)		12
Pillay (2011)		23
Hawkes and Ugur (2012)		37
Cloete <i>et al.</i> (2011)		9
Kimenyi (2011)		23
Creed <i>et al.</i> (2012)		5
	11	
Total imported		100

Website searches

Website	Records	Final number imported
3ie Database of Impact Evaluations	60	3
Association for the Development of Education in Africa	71	9
International Development Research Centre	200	15
Research for Development (DFID)	103	8
JOLIS	717	91
CHET	162	12
Labordoc	196	4
UNESDOC	135	8
African Journals Online	24	6
Asia Journals Online	23	5
Latin America Journals Online	775	4
Association of African Universities	32	4
Association of Commonwealth Universities	78	8
International Association of Universities	407	52
CODESRIA	25	3
HERANA	153	8
South East Asia Index	291	2
Total Imported		242

Other

Source	Number Imported
Initial report bibliography	3
Suggestion from expert panel member*	4
Source not recorded	1
Total imported	8

**All other EPM suggestions came through the database search*

TOTAL NUMBER TITLES IMPORTED: 12,213

Duplicates removed: 338

Titles removed following context restriction: 5,198

Titles included for screening on title and abstract: 6,677

Excluded based on title and abstract: 5,286

Retained as 'possibly include interventions': 84

Retained as 'possibly include assumptions': 445

Titles included for screening on full text: 862

Excluded based on full text: 624

Retained as 'possibly include interventions': 19

Retained as 'possibly include assumptions': 72

Titles included for quality appraisal: 147

Excluded based on quality: 48

Total number included for synthesis: 99

Appendix 4: Included and excluded countries

TO BE INCLUDED (Low- and lower-middle- income countries outside of Europe/former USSR)

“Low-income countries”

“Developing countries”

“Third World”

Regional sources looking at: Africa/Sub-Saharan Africa/North Africa, Middle East/Maghreb, Asia/South Asia/South-East Asia, Pacific Islands, Caribbean, Latin America, Central America

Afghanistan	Belize
Bangladesh	Bhutan
Benin	Bolivia
Burkina Faso	Cameroon
Burundi	Cape Verde
Cambodia	Congo (Rep.)/DRC
Central African Republic	Cote d’Ivoire/Ivory Coast
Chad	Djibouti
Comoros	Egypt
Congo (Dem. Rep.)	El Salvador
Eritrea	Fiji
Ethiopia	Ghana
Gambia, The	Guatemala
Guinea	Guyana
Guinea-Bissau	Honduras
Haiti	Indonesia
Kenya	India
Korea (Dem. Rep.)/North Korea	Iraq
Liberia	Kiribati
Madagascar	Lao
Malawi	Lesotho
Mali	Marshall Islands
Mauritania	Micronesia
Mozambique	Mongolia
Myanmar/Burma	Morocco
Nepal	Nicaragua
Niger	Nigeria
Rwanda	Pakistan
Sierra Leone	Papua New Guinea
Somalia	Paraguay
Tanzania	Philippines
Togo	Samoa
Uganda	Sao Tome and Principe
Zimbabwe	Senegal
	Solomon Islands

South Sudan
Sri Lanka
Sudan
Swaziland
Syria
Timor-Leste

Tonga
Vanuatu
Vietnam
West Bank, Gaza and Palestine
Yemen
Zambia

TO BE EXCLUDED (Low- and lower-middle- income countries in Europe/former USSR; upper-middle- and high-income countries)

Regional sources looking at: Europe, North America

Kyrgyz Republic
Tajikistan

Albania
Armenia
Georgia
Kosovo
Moldova
Ukraine
Uzbekistan

Angola
Algeria
American Samoa
Antigua and Barbuda
Argentina
Azerbaijan
Belarus
Bosnia and Herzegovina
Botswana
Brazil
Bulgaria
Chile
China (including Taiwan)
Colombia
Costa Rica
Cuba
Dominica
Dominican Republic
Ecuador
Gabon
Grenada
Iran

Jamaica
Jordan
Kazakhstan
Latvia
Lebanon
Libya
Lithuania
Macedonia
Malaysia
Maldives
Mauritius
Mexico
Montenegro
Namibia
Palau
Panama
Peru
Romania
Russian Federation
Serbia
Seychelles
South Africa
St. Lucia
St. Vincent and the Grenadines
Suriname
Thailand
Tunisia
Turkey
Turkmenistan
Tuvalu
Uruguay
Venezuela

Andorra	Poland
Aruba	Portugal
Australia	Puerto Rico
Austria	Qatar
Bahamas, The	San Marino
Bahrain	Saudi Arabia
Barbados	Singapore
Belgium	St. Maarten
Bermuda	Slovak Republic
Brunei	Slovenia
Canada	Spain
Cayman Islands	St. Kitts and Nevis
Channel Islands	St. Martin
Croatia	Sweden
Curaçao	Switzerland
Cyprus	Trinidad and Tobago
Czech Republic	Turks and Caicos
Denmark	United Arab Emirates
Estonia	United Kingdom
Equatorial Guinea	United States
Faroe Islands	US Virgin Islands
Finland	
France	
French Polynesia	
Germany	
Greece	
Greenland	
Guam	
Hong Kong	
Hungary	
Iceland	
Ireland	
Israel	
Italy	
Japan	
Korea (Rep)—or South Korea	
Kuwait	
Liechtenstein	
Luxembourg	
Macao	
Malta	
Monaco	
Netherlands	
New Zealand	
Northern Mariana Islands	
Norway	
Oman	

Appendix 5: Standards for quality appraisal

Transparency

- Does the study have a clear research question?
- Does the study clearly state which design and methods have been employed to answer the research question?
- Does the study clearly reference which data were used in analysis, the data source and how the data were collected?

Appropriateness

- Is the research design appropriate for the research question?
- Is the population from which the sample was drawn appropriate for the research question and design?²⁷
- Is the sampling method appropriate for the research question and design?
- Is the sample size appropriate for the analytical method?
- Is the sample representative of the population or pertinent to the purpose?
- Are the analytical techniques appropriate for the research question and design?

Validity and reliability of conclusions

- Are the data-collection methods valid in relation to the indicators/data required?
- Is there evidence of testing for reliability of data-collection tools and/or methods?
- Is there sufficient evidence to support the conclusions?
- Does the study take other possible factors, causes or explanations into consideration?
- Can the results be generalised to the extent advocated by the author?
- Is there a clear and coherent argument running through the study?

²⁷ Some of the questions about sampling are not appropriate for qualitative studies

Appendix 6: Summary of included studies

Citation	Type of source	Regional focus	Country or countries	Study design (incl. data source)	Development outcome(s) and level of impact
Earnings and externalities (66 included studies)					
<i>Individual earnings (48 included studies)</i>					
Abbas and Foreman-Peck (2008)	Journal article	South and South-East Asia	Pakistan	Estimates return to education for three sub-sectors of the labour market, by gender; secondary analysis of Pakistan Social and Living Standards Measurement (PSLM) Survey, 2004-05	DEV'T OUTCOME: Gender LEVEL OF IMPACT: National
Afzal (2011)	Journal article	South and South-East Asia	Pakistan	Questionnaire distributed (in 2009) to 3,358 teaching and non-teaching employees of institutions in Lahore District (universities, colleges, schools)	DEV'T OUTCOME: Income equality LEVEL OF IMPACT: Local
Agesa, Agesa and Dabalen (2013)	Journal article	SSA	Kenya	The authors' empirical technique mirrors re-centred influence-function regressions (based on household survey)	DEV'T OUTCOME: Gender LEVEL OF IMPACT: National
Akita and Miyata (2008)	Journal article	South and South-East Asia	Indonesia	Household survey	DEV'T OUTCOME: Income equality LEVEL OF IMPACT: National

The Impact of Tertiary Education on Development: A Rigorous Literature Review

Al-Samarrai and Bennell (2007)	Journal article	SSA	Malawi, Tanzania, Uganda and Zimbabwe	Tracer surveys; representative samples of secondary-school leavers and university graduates	DEV'T OUTCOMES: Growth, gender, health LEVEL OF IMPACT: Regional
Al-Samarrai and Reilly (2008)	Journal article	SSA	Tanzania	Tracer survey of secondary-school completers, conducted 2001	DEV'T OUTCOME: Income equality LEVEL OF IMPACT: National
Amaghionyeodiwe and Osinubi (2007)	Journal article	SSA	Nigeria	Use of institutional statistical records	DEV'T OUTCOME: Growth LEVEL OF IMPACT: National
Asghar and Zahra (2012)	Journal article	South and South-East Asia	Pakistan	Use of household survey; benefit-incidence analysis	DEV'T OUTCOMES: Poverty LEVEL OF IMPACT: National
Azam (2010)	Journal article	South and South-East Asia	India	Use of household-survey data (1983-2005); Analysis = demand and supply model with imperfect substitution across age groups	DEV'T OUTCOME: Income equality LEVEL OF IMPACT: National

Azam (2012)	Journal article	South and South-East Asia	India	Use of individual-level earnings data from urban India (household survey, 1983-2004)	DEV'T OUTCOME: Income equality LEVEL OF IMPACT: National
Born, McMaster and De Jong (2008)	Journal article	Pacific Islands	Regional study (emphasis on Fiji)	Based on alumni questionnaire; descriptive statistics and cost-benefit analysis	DEV'T OUTCOME: Gender LEVEL OF IMPACT: National and local
Deolalikar (1993)	Journal article	South and South-East Asia	Indonesia	Household-survey data (1987)	DEV'T OUTCOME: Gender LEVEL OF IMPACT: National
Diagne and Diene (2011)	Journal article	SSA	Regional study	Meta-analysis, using results from a number of other empirical studies	DEV'T OUTCOME: Growth LEVEL OF IMPACT: Regional
Doan and Stevens (2011)	Journal article	South and South-East Asia	Vietnam	Vietnam Household Living Standards Survey (VHLSS), 2008 Analysis = Ordinary Least Squares, Instrumental Variables and Treatment Effect models to estimate return to four-year university education	DEV'T OUTCOME: Income equality LEVEL OF IMPACT: National

The Impact of Tertiary Education on Development: A Rigorous Literature Review

Duraisamy (2000)	Report	South and South-East Asia	India	National-level representative household survey data (1983-94)	DEV'T OUTCOMES: Growth, income equality, gender LEVEL OF IMPACT: National
Dutta (2006)	Journal article	South and South-East Asia	India	National employment surveys (1983, 1993-94 and 1999-2000)	DEV'T OUTCOME: Income inequality, poverty LEVEL OF IMPACT: National
El-Hamidi (2006)	Journal article	Middle East and North Africa	Egypt	Data from Egyptian Labor Market Survey, 1998	DEV'T OUTCOMES: Income equality, gender LEVEL OF IMPACT: National
Fasih, Kingdon, Patrinos, Sakellariou and Soderbom (2012)	World Bank report	Global	All low-income countries—emphasis on India, Pakistan, Ghana, Kenya and Tanzania	Reviews evidence from prior research studies (for example, Appleton et al, 1999; Patrinos et al, 2009) Regression analysis by quintile—consideration of different groups (for example, skilled versus unskilled workers)	DEV'T OUTCOME: Income equality LEVEL OF IMPACT: National
Fonkeng and Ntembe (2009)	Journal article	SSA	Cameroon	Household-survey data	DEV'T OUTCOME: Growth, gender LEVEL OF IMPACT: National

Frisancho Robles and Krishna (2012)	NBER working paper	South and South-East Asia	India	Use of institutional dataset	DEV'T OUTCOMES: Income equality, equity LEVEL OF IMPACT: National
Glewwe, Gragnolati and Zaman (2002)	Journal article	South and South-East Asia	Vietnam	Data from two Vietnam Living Standards Surveys (1992-93 and 1997-98, N = 4,800 and 6,000 households, respectively)	DEV'T OUTCOMES: Poverty, equity LEVEL OF IMPACT: National
Grootaert (1990)	Journal article	SSA	Cote d'Ivoire	Data from household survey	DEV'T OUTCOME: Income equality LEVEL OF IMPACT: National
Grootaert, Kanbur and Oh (1995)	World Bank report	SSA	Cote d'Ivoire	Data from household survey	DEV'T OUTCOME: Poverty LEVEL OF IMPACT: National
Gyimah-Brempong, Paddison and Mitiku (2006)	Journal article	SSA	Regional study	Data from World Development Indicators, Singer's Correlates of War project (data from 1816-1998), Bates' African Research project (publication dates not specified) and Barro and Lee's (2000) dataset (data from 1960-2000)	DEV'T OUTCOME: Growth LEVEL OF IMPACT: Regional

The Impact of Tertiary Education on Development: A Rigorous Literature Review

Kahyarara and Teal (2008)	Journal article	SSA	Tanzania	Data from surveys of Tanzania's manufacturing sector (1999-2000, 2002)	DEV'T OUTCOME: Income equality LEVEL OF IMPACT: National
Keller (2006)	Journal article	Global	All low-income countries	World Bank data (since 1960)	DEV'T OUTCOME: Growth, governance LEVEL OF IMPACT: National
Kimenyi, Mwabu and Manda (2006)	Journal article	SSA	Kenya	Data from Kenya's Welfare Monitoring Survey (1994) and from district-level education statistics	DEV'T OUTCOMES: Income equality, gender LEVEL OF IMPACT: National and local
Kingdon and Unni (2001)	Journal article	South and South-East Asia	India	Household-survey data	DEV'T OUTCOME: Gender LEVEL OF IMPACT: National
Kristensen and Verner (2008)	Journal article	SSA	Cote d'Ivoire	Data from employer-employee surveys within the manufacturing sector	DEV'T OUTCOME: Income equality LEVEL OF IMPACT: Local

Lassibille and Tan (2005)	Journal article	SSA	Rwanda	Data from national Household Living Conditions Survey (1999-2001)	DEV'T OUTCOME: Income equality LEVEL OF IMPACT: National
Manda, Mwabu and Kimenyi (2002)	Journal article	SSA	Kenya	Data from national Welfare Monitoring Survey (1994)	DEV'T OUTCOMES: Income equality, gender LEVEL OF IMPACT: National
McMahon (1999)	Book	All low-income countries	Asia: Indonesia, Philippines, India, Sri Lanka, Nepal; LAC: Bolivia, El Salvador, Guyana, Haiti, Honduras, Nicaragua; Africa: Benin, Burkina Faso, Burundi, CAR, Congo, Ethiopia, Ghana, Kenya, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Nigeria, Rwanda, Senegal,	Secondary research; quantitative (analysis of secondary datasets) 1965-95 (includes analysis of time lag)	DEV'T OUTCOMES: All LEVEL OF IMPACT: Regional

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			Somalia, Sudan, Tanzania, Togo, Tunisia, DRC, Zambia, Zimbabwe		
McMahon (2003)	Book chapter	All low-income countries	All low-income countries	Secondary research; quantitative (analysis of secondary datasets) 1965-95 (includes analysis of time lag)	DEV'T OUTCOMES: All LEVEL OF IMPACT: Regional
Moock, Patrinos and Venkataraman (2003)	Journal article	South and South-East Asia	Vietnam	Data from Vietnam Living Standards Survey (1992-93)	DEV'T OUTCOMES: Growth, income equality, gender LEVEL OF IMPACT: National
Nsowah-Nuamah, Teal and Awoonor-Williams (2012)	Journal article	SSA	Ghana	Data from three Ghana Living Standards Surveys (1991-92, 1998-99 and 2005-06)	DEV'T OUTCOME: Growth, income equality, poverty LEVEL OF IMPACT: National
Obwana and Ssewanyana (2007)	EPRC working paper	SSA	Uganda	Data from national household surveys (1992-93, 1999-2000, 2002-03)	DEV'T OUTCOMES: Growth, poverty, gender LEVEL OF IMPACT: National

Psacharopoulos (1994)	Journal article	Global	All low-income countries	Based on World Bank data and data collected by other researchers (most collected between 1985 and 1995)	DEV'T OUTCOMES: Growth, income equality, gender LEVEL OF IMPACT: National
Psacharopoulos and Patrinos (2004)	Journal article	Global	All low-income countries	Based on World Bank data and data collected by other researchers (most published between 1990 and 1995)	DEV'T OUTCOME: Growth, income equality, gender LEVEL OF IMPACT: National
Psacharopoulos, Velez and Patrinos (1994)	Journal article	Latin America and Caribbean	Paraguay	1990 Household Survey data	DEV'T OUTCOME: Growth, income equality, gender LEVEL OF IMPACT: National
Rolleston and Oketch (2008)	Journal article	SSA	Ghana	Data collected from a small-scale survey (conducted at one higher-education institution) and from the Ghana Statistical Service's ongoing living standards surveys (1991-92, 1998-99)	DEV'T OUTCOMES: Growth, income equality LEVEL OF IMPACT: National
Rugar, Ayodo and Agak (2010)	Journal article	SSA	Kenya	Questionnaire distributed to 253 lecturers at two public universities; primary data on financial costs, earnings, age, schooling, and experience were obtained through use of a questionnaire while secondary data from official documents provided additional data on costs	DEV'T OUTCOMES: Income equality LEVEL OF IMPACT: National

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Schady (2003)	Journal article	South and South-East Asia	Philippines	Annual Poverty Indicator Survey (APIS), 1998	DEV'T OUTCOME: Income equality LEVEL OF IMPACT: National
Schultz (2004)	Journal article	SSA	Ghana, Cote d'Ivoire, Kenya	Household surveys (1985, 1998)	DEV'T OUTCOME: Growth, income equality LEVEL OF IMPACT: National
Soderbom, Teal, Wambugu and Kahyarara (2006)	Journal article	SSA	Kenya, Tanzania	Data from employee surveys of the manufacturing sector (1993-2001)	DEV'T OUTCOME: Growth LEVEL OF IMPACT: National
Teal (2011)	Journal article	SSA	Regional study (32 countries)	Penn World Tables and Barro and Lee (2010) dataset	DEV'T OUTCOMES: Growth, income equality LEVEL OF IMPACT: Regional and national
Uwaifo Oyelere (2011)	Journal article	SSA	Nigeria	Data from General Household Survey in Nigeria (1998, 1999, 2000)	DEV'T OUTCOME: Growth, income equality LEVEL OF IMPACT: National

Vijverberg (1993)	Journal article	SSA	Cote d'Ivoire	Cote d'Ivoire Living Standards Survey (1985-87)	DEV'T OUTCOME: Income equality, gender LEVEL OF IMPACT: National
World Bank (2010)	World Bank report	SSA	Malawi	National data—including household surveys, World Bank data	DEV'T OUTCOMES: Growth, income equality, gender LEVEL OF IMPACT: National
<i>Economic growth (25 included studies)</i>					
Afzal, Rehman, Farooq and Sarwar (2011)	Journal article	South and South-East Asia	Pakistan	Exploration of co-integration and causality between education and economic growth, using time-series data on real gross domestic product (GDP), labour force, physical capital and education (1970-71 to 2008-09)	DEV'T OUTCOME: Growth LEVEL OF IMPACT: National
Agiomirgianakis, Asteriou and Monastiriotis (2002)	Journal article	Global	93 countries	Dynamic-panel approach based on institutional statistical records	DEV'T OUTCOME: Growth LEVEL OF IMPACT: National
Asiedu and Nandwa (2007)	Journal article	Global	90 countries (56 middle-income, 34 low-income)	Dynamic-panel estimator method; regression used to determine how different levels of education aid (aggregate, primary, secondary, higher) impact growth; then disaggregation by level of national income (that is, low-income countries versus middle-income countries)	DEV'T OUTCOME: Growth LEVEL OF IMPACT: National

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				Aid-disbursement data obtained from 5-CRS/Aid Activities-Disbursements database, part of the OECD Development Assistance Committee (DAC) Credit Reporting System (CRS); data on other variables from <i>International Country Risk Guide</i> and <i>World Development Indicators</i> , 1990-2004	
Bloom, Canning and Chan (2006)	World Bank report	SSA	Regional study	Use of unbalanced panel datasets (published by other researchers) and output data from Penn World Tables and World Bank; data on other variables from ILO and World Development Indicators (1960-2000) Construction of statistical model (non-linear estimator with lagged growth rates of inputs and lagged output growth as instruments for current growth rates)	DEV'T OUTCOME: Growth, income equality, poverty LEVEL OF IMPACT: Regional
Dahal (2010)	Journal article	South and South-East Asia	Nepal	Use of time-series data on enrolments in higher education and teachers working in lower-secondary and secondary schools and GDP (1975-2009) Data obtained from ministry documents	DEV'T OUTCOME: Growth LEVEL OF IMPACT: National
Fonkeng and Ntembe (2009)	Journal article	SSA	Cameroon	Household-survey data	DEV'T OUTCOME: Growth, gender LEVEL OF IMPACT: National

Ganegodage and Rambaldi (2011)	Journal article	South and South-East Asia	Sri Lanka	Data estimated using perpetual inventory formula (Binder and Pesaran 1998) with 4% depreciation rate; working-age population used as proxy for labour force; secondary-school “stock” calculated based on number of people with secondary-school education and university “stock” from number of graduates from Sri Lankan TEIs (1959-2008)	DEV'T OUTCOME: Growth LEVEL OF IMPACT: National
Gyimah-Brempong, Paddison and Mitiku (2006)	Journal article	SSA	Regional study	Data from World Development Indicators, Singer's Correlates of War project (data from 1816-1998), Bates' African Research project (publication dates not specified) and Barro and Lee's (2000) dataset (data from 1960-2000)	DEV'T OUTCOME: Growth LEVEL OF IMPACT: Regional
Gyimah-Brempong (2010)	Conference paper	SSA	Regional study	Data from World Development Indicators, WHO Statistical Services, PRIO, OECD Development Assistance Committee, International Country Risk Guide and Barro and Lee's dataset (2010), covering data from the period 1960-2010 (although period of analysis differs by outcome considered)	DEV'T OUTCOMES: Growth, gender, health, governance, institutions LEVEL OF IMPACT: Regional
Heaton (1999)	Journal article	Pacific Islands	Fiji	Data from survey of public-sector workers (17,000+ respondents), 1994	DEV'T OUTCOMES: Growth, Poverty LEVEL OF IMPACT: National
Keller (2006)	Journal article	Global	All low-income countries	World Bank data (since 1960)	DEV'T OUTCOME: Growth, governance LEVEL OF IMPACT: National

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Kyaw and Macdonald (2009)	Journal article	Global	126 low-income countries	Unbalanced panel data (from World Development Indicators), 1985-2002	DEV'T OUTCOME: Growth LEVEL OF IMPACT: National
Loening (2005)	Journal article	Latin America and Caribbean	Guatemala	Secondary research on World Bank and national data (1951-2002)	DEV'T OUTCOME: Growth LEVEL OF IMPACT: National
McMahon (1999)	Book	All low-income countries	Asia: Indonesia, Philippines, India, Sri Lanka, Nepal; LAC: Bolivia, El Salvador, Guyana, Haiti, Honduras, Nicaragua; Africa: Benin, Burkina Faso, Burundi, CAR, Congo, Ethiopia, Ghana, Kenya, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Nigeria, Rwanda, Senegal, Somalia, Sudan,	Secondary research; quantitative (analysis of secondary datasets) 1965-1995 (includes analysis of time lag)	DEV'T OUTCOMES: All LEVEL OF IMPACT: Regional

			Tanzania, Togo, Tunisia, DRC, Zambia, Zimbabwe		
McMahon (2003)	Book chapter	All low- income countries	All low- income countries	Secondary research; quantitative (analysis of secondary datasets) 1965-95 (includes analysis of time lag)	DEV'T OUTCOMES: All LEVEL OF IMPACT: Regional
Ndiyo (2007)	Journal article	SSA	Nigeria	Data from International Financial Statistics Yearbook (IMF), and two national datasets: Statistical Abstract (a publication of Nigeria's Federal Office of Statistics) and Statistical Bulletin (a publication of the Central Bank of Nigeria), 1970-2000	DEV'T OUTCOME: Growth LEVEL OF IMPACT: National

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Nyarko (2011)	NBER working paper	SSA	Ghana	Data from UN, Ghana Living Standards Surveys and datasets of other researchers (for example, Doquier et al. 2005) Econometric modelling with cost-benefit analysis	DEV'T OUTCOME: Growth LEVEL OF IMPACT: National
Obwana and Ssewanyana (2007)	EPRC working paper	SSA	Uganda	Data from national household surveys (1992-93, 1999-2000, 2002-03)	DEV'T OUTCOMES: Growth, poverty, gender LEVEL OF IMPACT: National
Ramos, Estudillo, Sawada and Otsuka (2012)	Journal article	South and South-East Asia	Philippines	Data from Family Income and Expenditure Surveys (1988-2006)	DEV'T OUTCOMES: Growth, income equality, poverty LEVEL OF IMPACT: National
Self and Grabowski (2004)	Journal article	South and South-East Asia	India	World Development Indicators, Penn World Tables and Barro and Lee dataset (1966-98)	DEV'T OUTCOME: Growth, gender LEVEL OF IMPACT: National
Stengos and Aurangzeb (2008)	Journal article	South and South-East Asia	Pakistan	Data collected from a wide range of national statistical records in Pakistan (1973-2001)	DEV'T OUTCOME: Growth, gender LEVEL OF IMPACT: National

Teal (2011)	Journal article	SSA	Regional study (32 countries)	Penn World Tables and Barro and Lee (2010) dataset	DEV'T OUTCOMES: Growth, Income Equality LEVEL OF IMPACT: Regional and National
Tilak (2003)	Journal article	East Asia; South and South-East Asia	Regional study	Data from UNESCO, UNDP and World Bank	DEV'T OUTCOME: Growth, income equality, poverty, health, population LEVEL OF IMPACT: National
Tilak (2010)	Journal article	Global	All low-income countries	World Development Indicators, Human Development Report	DEV'T OUTCOMES: Growth, income equality, poverty, health LEVEL OF IMPACT: Regional
Wolff and Gittleman (1993)	Book chapter	Global	All low-income countries	Summers-Heston dataset (1991) and World Bank data (1950-88)	DEV'T OUTCOME: Growth LEVEL OF IMPACT: Regional
Productivity (13 included studies)					
Abbas and Foreman-Peck (2008)	Journal article	South and South-East Asia	Pakistan	Estimates return to education for three sub-sectors of the labour market, by gender; secondary analysis of Pakistan Social and Living Standards Measurement (PSLM) Survey, 2004-05	DEV'T OUTCOME: Gender LEVEL OF IMPACT: National

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Al-Samarrai and Bennell (2007)	Journal article	SSA	Malawi, Tanzania, Uganda and Zimbabwe	Tracer surveys; representative samples of secondary-school leavers and university graduates	DEV'T OUTCOMES: Growth, Gender, health LEVEL OF IMPACT: Regional
Bloom, Canning and Chan (2006)	World Bank report	SSA	Regional study	Use of unbalanced panel datasets (published by other researchers) and output data from Penn World Tables and World Bank; data on other variables from ILO and World Development Indicators (1960-2000) Construction of statistical model (non-linear estimator with lagged growth rates of inputs and lagged output growth as instruments for current growth rates)	DEV'T OUTCOME: Growth, income equality, poverty LEVEL OF IMPACT: Regional
de Ferranti, Perry, Gill, Guasch, Maloney, Sanchez-Paramo and Schady (2003)	World Bank report	Latin America and Caribbean	Regional study	Draws on regional macroeconomic, firm-level and household data to study the interaction between technology and skills (1980-2000) Mixed-method analysis (documentary/policy analysis, descriptive statistics, econometric modelling)	DEV'T OUTCOME: Growth, institutions LEVEL OF IMPACT: Regional
Di Gropello, Tandon and Yusuf (2012)	World Bank report	East Asia; South and South-East Asia	Regional study	Primary and secondary research; quantitative (statistical analysis of secondary datasets and firm survey, econometric modelling)	DEV'T OUTCOMES: Growth, institutions LEVEL OF IMPACT: National

				1970-2007, with most since 1996 (dates of published datasets, although their data collection is likely to have been much earlier)	
Diagne and Diene (2011)	Journal article	SSA	Regional study	Meta-analysis, using results from a number of other empirical studies	DEV'T OUTCOME: Growth LEVEL OF IMPACT: Regional
Larbi-Apau and Sarpong (2010)	Journal article	SSA	Ghana	Data from cross-section survey of 120 poultry farms in greater Accra region, conducted in 2000 => questionnaire returned by 60 and data from 33 used for analysis	DEV'T OUTCOMES: Growth, institutions LEVEL OF IMPACT: National
Loening (2005)	Journal article	Latin America and Caribbean	Guatemala	Secondary research on World Bank and national data (1951-2002)	DEV'T OUTCOME: Growth LEVEL OF IMPACT: National
McMahon (1999)	Book	All low-income countries	Asia: Indonesia, Philippines, India, Sri Lanka, Nepal; LAC: Bolivia, El Salvador, Guyana, Haiti, Honduras, Nicaragua; Africa: Benin, Burkina Faso, Burundi, CAR, Congo, Ethiopia,	Secondary research; quantitative (analysis of secondary datasets) 1965-95 (includes analysis of time lag)	DEV'T OUTCOMES: All LEVEL OF IMPACT: Regional

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			Ghana, Kenya, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Nigeria, Rwanda, Senegal, Somalia, Sudan, Tanzania, Togo, Tunisia, DRC, Zambia, Zimbabwe		
McMahon (2003)	Book chapter	All low-income countries	All low-income countries	Secondary research; quantitative (analysis of secondary datasets) 1965-95 (includes analysis of time lag)	DEV'T OUTCOMES: All LEVEL OF IMPACT: Regional
Ndiyo (2007)	Journal article	SSA	Nigeria	Data from International Financial Statistics Yearbook (IMF), and two national datasets - Statistical Abstract (a publication of Nigeria's Federal Office of Statistics) and Statistical Bulletin (a publication of the Central Bank of Nigeria), 1970-2000	DEV'T OUTCOME: Growth LEVEL OF IMPACT: National
Teal (2011)	Journal article	SSA	Regional study (32 countries)	Penn World Tables and Barro and Lee (2010) dataset	DEV'T OUTCOMES: Growth, income equality LEVEL OF IMPACT: Regional and national

Wolff and Gittleman (1993)	Book chapter	Global	All low-income countries	Summers-Heston dataset (1991) and World Bank data (1950-88)	DEV'T OUTCOME: Growth LEVEL OF IMPACT: Regional
<i>Technology transfer (Eight included studies)</i>					
Ca (2006)	World Bank report	South and South-East Asia	Vietnam	Primary research; qualitative (literature review, interviews with firms, case studies)	DEV'T OUTCOME: Growth, institutions LEVEL OF IMPACT: Local, national
Collins (2012)	Journal article	Sub-Saharan Africa	Rwanda	Primary research; qualitative case study (interviews, review of institutional/programme records)	DEV'T OUTCOME: Poverty, institutions LEVEL OF IMPACT: Local
de Ferranti, Perry, Gill, Guasch, Maloney, Sanchez-Paramo and Schady (2003)	World Bank report	Latin America and Caribbean	Belize, Bolivia, El Salvador, Guatemala, Guyana, Haiti, Honduras, Nicaragua, Paraguay	Secondary research; mixed-method (review of policy documents and statistical analysis of secondary datasets) 1992-2002 (dates of published datasets, although their data collection is likely to have been much earlier)	DEV'T OUTCOME: Growth, institutions LEVEL OF IMPACT: Regional
Di Gropello, Tandon and Yusuf (2012)	World Bank report	East Asia; South and South-East Asia	Indonesia, Mongolia, Philippines, Cambodia, Lao, Vietnam	Primary and secondary research; quantitative (statistical analysis of secondary datasets and firm survey) 1970-2007, with most since 1996 (dates of published datasets, although their data collection is likely to have been much earlier)	DEV'T OUTCOMES: Growth, institutions LEVEL OF IMPACT: National

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Gondo and Dafuleya (2010)	Journal article	SSA	Ethiopia	Data collected through stakeholder interviews and document/policy analysis	DEV'T OUTCOME: Institutions LEVEL OF IMPACT: National
Loening (2005)	World Bank report	Latin America and Caribbean	Guatemala	Secondary research on World Bank and national data (1950-2002)	DEV'T OUTCOME: Growth LEVEL OF IMPACT: National
Magara, Bukirwa and Kayiki (2011)	Journal article <i>(African Journal of Library Archives and Information Science)</i>	Sub-Saharan Africa	Uganda	Primary research; qualitative (document analysis of questionnaires provided to participating students, institutions and faculty supervisors) Internships (109 in total) took place between 2006 and 2008	DEV'T OUTCOME: Institutions LEVEL OF IMPACT: Local
McMahon (1999)	Book	All low-income countries	Asia: Indonesia, Philippines, India, Sri Lanka, Nepal; LAC: Bolivia, El Salvador, Guyana, Haiti, Honduras, Nicaragua; Africa: Benin, Burkina Faso, Burundi, CAR, Congo, Ethiopia, Ghana, Kenya, Liberia,	Secondary research; quantitative (analysis of secondary datasets) 1965-95 (includes analysis of time lag)	DEV'T OUTCOMES: All LEVEL OF IMPACT: Regional

			Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Nigeria, Rwanda, Senegal, Somalia, Sudan, Tanzania, Togo, Tunisia, DRC, Zambia, Zimbabwe		
Capabilities (24 included studies)					
<i>Overall capabilities</i>					
McMahon (1999)	Book	All low-income countries	Asia: Indonesia, Philippines, India, Sri Lanka, Nepal; LAC: Bolivia, El Salvador, Guyana, Haiti, Honduras, Nicaragua; Africa: Benin, Burkina Faso, Burundi, CAR, Congo, Ethiopia, Ghana, Kenya, Liberia, Madagascar, Malawi, Mali, Mauritania,	Secondary research; quantitative (analysis of secondary datasets) 1965-95 (includes analysis of time lag)	DEV'T OUTCOMES: All LEVEL OF IMPACT: Regional

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			Mauritius, Morocco, Nigeria, Rwanda, Senegal, Somalia, Sudan, Tanzania, Togo, Tunisia, DRC, Zambia, Zimbabwe		
McMahon (2003)	Book chapter	All low-income countries	All low-income countries	Secondary research; quantitative (analysis of secondary datasets) 1965-95 (includes analysis of time lag)	DEV'T OUTCOMES: All LEVEL OF IMPACT: Regional
<i>Citizenship and political participation</i>					
Luescher-Mamashela, Kiiru, Mattes, Mwollo-ntallima, Ng'ethe and Romo (2011)	CHET Report	SSA	Kenya, Tanzania	Student surveys at University of Nairobi and University of Dar-es-Salaam	DEV'T OUTCOMES: Governance, institutions LEVEL OF IMPACT: National
Mattes and Mughogho (2009)	CSSR working paper	SSA	Regional study	Secondary analysis of Afrobarometer data	DEV'T OUTCOMES: Governance, institutions LEVEL OF IMPACT: National
<i>Health and nutrition</i>					
Agrawal, Murthy, Philip, Mehrotra, Thennarasu, John, Girish, Thippeswamy and Isaac (2011)	Journal article	South and South-East Asia	India	Adults (n = 1,099) belonging to two wards in the city of Bangalore in South India, responded to a study-specific questionnaire; data subjected to step-wise regression analysis	DEV'T OUTCOME: Health LEVEL OF IMPACT: Local

Ahmed (2010)	Journal article	SSA	Sudan	Secondary (regression) analysis of household data from the central region of Sudan; examined the effect of parental education, income, mother's age, residence area—together with the effect of the interaction between fertility and child mortality on fertility	DEV'T OUTCOME: Population LEVEL OF IMPACT: Local
Akin (2005)	Journal article	Middle East and North Africa	Regional study (Iraq, Syria)	Use of a pooled cross-sectional time series GLS model; based on documents from international organisation(s), 1980-98	DEV'T OUTCOME: Population LEVEL OF IMPACT: Regional
Akinyemi (2012)	Journal article	SSA	Nigeria	The Aging Males Symptoms scale questionnaire was administered to 456 males aged 60 years and above in selected communities in Ijesaland, south-west Nigeria. Three outcome variables for psychosocial, somatic and sexual scores were used, together with socio-economic variables as co-variates. Analysis included frequency distribution, chi-square test and logistic-regression model	DEV'T OUTCOME: Health LEVEL OF IMPACT: Local
Burchi and De Muro (2007)	Report	Global	48 countries	Use of DHS data Statistical analysis	DEV'T OUTCOME: Poverty, health LEVEL OF IMPACT: National
Gyimah-Brempong (2010)	Conference paper	SSA	Regional study	Data from World Development Indicators, WHO Statistical Services, PRIO, OECD Development Assistance Committee, International Country Risk Guide and Barro and Lee's (2010) dataset 1960-2010 (although period of analysis differs by outcome considered)	DEV'T OUTCOMES: Growth, gender, health, governance, institutions LEVEL OF IMPACT: Regional

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Omotara, Padonu and Yahya (2004)	Journal article	SSA	Nigeria	Focus groups with community leaders	DEV'T OUTCOME: Health LEVEL OF IMPACT: Local
Raghbendra and Dang (2012)	Journal article	South and South-East Asia	East Timor	Cross-sectional data from the 2001 Timor-Leste Living Standard Measurement Survey	DEV'T OUTCOME: Health LEVEL OF IMPACT: National
Sansone, Raute, Fong, Pednekar, Quah, Bansal-Travers, Gupta and Sinha (2012)	Journal article	South and South-East Asia	India	TCP India Pilot Survey, conducted by the ITC Project; data collected from 249 current smokers in both urban and rural areas in two states (Maharashtra and Bihar) in 2006	DEV'T OUTCOME: Health LEVEL OF IMPACT: Local
Tilak (2003)	Journal article	East Asia; South and South-East Asia	Regional study	Data from UNESCO, UNDP and World Bank	DEV'T OUTCOME: Growth, income equality, poverty, health, population LEVEL OF IMPACT: National
Tilak (2010)	Journal article	Global	All low-income countries	World Development Indicators, Human Development Report	DEV'T OUTCOMES: Growth, income equality, poverty, health LEVEL OF IMPACT: Regional

<i>Women's empowerment</i>					
Dalal (2008)	Journal article	SSA	Kenya	Use of DHS data (2003)	DEV'T OUTCOME: Gender LEVEL OF IMPACT: National
DeRose, Dodoo and Patil (2002)	Journal article	SSA	Ghana	Focus-group data from the University of Ghana Narrative analysis and descriptive statistics	DEV'T OUTCOME: Gender, population LEVEL OF IMPACT: National
Gyimah-Brempong (2010)	Conference paper	SSA	Regional study	Data from World Development Indicators, WHO Statistical Services, PRIO, OECD Development Assistance Committee, International Country Risk Guide and Barro and Lee's (2010) dataset 1960-2010 (although period of analysis differs by outcome considered)	DEV'T OUTCOMES: Growth, gender, health, governance, institutions LEVEL OF IMPACT: Regional
Malik and Courtney (2011)	Journal article	South and South-East Asia	Pakistan	Survey administered to female faculty members and female students from 10 public universities in Pakistan (n=1,290 students and 290 faculty members). Subsequently, semi-structured interviews were held with 10 faculty members and 10 students.	DEV'T OUTCOME: Gender LEVEL OF IMPACT: National
Müller (2004)	Journal article	SSA	Eritrea	Interviews with 29 female students in their final year of study and survey of 300+ male and female students at the university (conducted 2000-01)	DEV'T OUTCOME: Gender LEVEL OF IMPACT: National

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Singh, Thind and Jaswal (2006)	Journal article	South and South-East Asia	India	Two questionnaires—one socio-demographic and marital-adjustment questionnaire—administered to 300 Sikh families, sampled by work status and education level of the wife	DEV'T OUTCOME: Gender LEVEL OF IMPACT: Local
Utomo (2012)	Journal article	South and South-East Asia	Indonesia	Survey of 1,700+ university students; follow-up interviews (conducted 2004)	DEV'T OUTCOME: Gender LEVEL OF IMPACT: Local
<i>Other empowerment</i>					
Mwaipopo, Lihamba and Njewe (2011)	Journal article	SSA	Tanzania	Mixed-method (interviews and analysis of secondary institutional data)	DEV'T OUTCOMES: Equity, governance LEVEL OF IMPACT: National
<i>Employment</i>					
Al-Samarrai and Bennell (2007)	Journal article	SSA	Malawi, Tanzania, Uganda and Zimbabwe	Tracer surveys; representative samples of secondary-school leavers and university graduates	DEV'T OUTCOMES: Growth, gender, health LEVEL OF IMPACT: Regional
Thomas (2008)	Journal article	SSA	Uganda	National census (2001)	DEV'T OUTCOME: Income equality LEVEL OF IMPACT: National

<i>Institutions (13 Included Studies)</i>					
<i>Democratisation, governance and political institutions</i>					
Gyimah-Brempong (2010)	Conference paper	SSA	Regional study	Data from World Development Indicators, WHO Statistical Services, PRIO, OECD Development Assistance Committee, International Country Risk Guide and Barro and Lee's (2010) dataset 1960-2010 (although period of analysis differs by outcome considered)	DEV'T OUTCOMES: Growth, gender, health, governance, institutions LEVEL OF IMPACT: Regional
Keller (2006)	Journal article	Global	All low-income countries	World Bank data (since 1960)	DEV'T OUTCOME: Growth, governance LEVEL OF IMPACT: National
Mattes and Mozaffar (2011)	CHET Report	SSA	11 countries	Questionnaires and interviews	DEV'T OUTCOMES: Governance, institutions LEVEL OF IMPACT: National
McMahon (1999)	Book	All low-income countries	Asia: Indonesia, Philippines, India, Sri Lanka, Nepal; LAC: Bolivia, El Salvador, Guyana, Haiti, Honduras, Nicaragua; Africa: Benin, Burkina Faso,	Secondary research; quantitative (analysis of secondary datasets) 1965-95 (includes analysis of time lag)	DEV'T OUTCOMES: All LEVEL OF IMPACT: Regional

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			Burundi, CAR, Congo, Ethiopia, Ghana, Kenya, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Nigeria, Rwanda, Senegal, Somalia, Sudan, Tanzania, Togo, Tunisia, DRC, Zambia, Zimbabwe		
McMahon (2003)	Book chapter	All low-income countries	All low-income countries	Same as above	DEV'T OUTCOMES: All LEVEL OF IMPACT: Regional
Shafiq (2010)	Journal article	South and South-East Asia	Pakistan, Indonesia	Pew Global Attitudes Project survey (2005)	DEV'T OUTCOME: Governance LEVEL OF IMPACT: National
Truex (2011)	Journal article	South and South-East Asia	Nepal	Survey	DEV'T OUTCOME: Governance LEVEL OF IMPACT: Local

Urdal (2006)	Journal article	Global	All low-income countries	Time-series data collected through censuses (1950-2000)	DEV'T OUTCOME: Governance LEVEL OF IMPACT: National
<i>Public Services</i>					
Ehrhardt-Martinez (1998)	Journal article	Global	51 countries	Data from international organisation documents (Figures are for 1965-80)	DEV'T OUTCOME: Environment LEVEL OF IMPACT: National
Harris and Lewer (2005)	Journal article	South and South-East Asia	Sri Lanka	Use of institutional statistics/records and interviews/surveys with alumni Case-study analysis	DEV'T OUTCOMES: Governance, institutions LEVEL OF IMPACT: National
Magara, Bukirwa and Kayiki (2011)	Journal article	SSA	Uganda	Primary research; qualitative (document analysis of questionnaires provided to participating students, institutions and faculty supervisors) Internships (109 in total) took place between 2006 and 2008	DEV'T OUTCOME: Institutions LEVEL OF IMPACT: Local
Oman, Moulds and Usher (2009)	Journal article	Pacific Islands	Fiji	Institutional data collected on the whereabouts and highest educational attainments of the 66 Fiji doctors who had undertaken specialist training to at least diploma level between 1997 and 2004. Semi-structured interviews focusing on career decisions were then carried out with 36 of these doctors, who were purposively sampled to include	DEV'T OUTCOMES: Health, institutions LEVEL OF IMPACT: National

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				overseas migrants, temporary overseas trainees, local private practitioners and public-sector doctors	
Wright and Plasterer (2010)	Journal article	SSA	Kenya	Interviews with practitioners, observation in schools and data from refugee-service providers	DEV'T OUTCOME: Equity LEVEL OF IMPACT: Local

Appendix 7: Case studies

This appendix comprises two case studies that are intended to support the main review by providing an illustration of how pathways—and barriers—to impact operate differentially in particular contexts. As discussed in sub-section 6.2, we elected to consider two countries from the same geographic region, which have had different historical trajectories and different experiences with TE. We first consider the case of Kenya, a country with a long history of TE, before turning to the case of Rwanda, a country that has recently redeveloped its TE system.

A. The case of Kenya

1. TE in Kenya

Sessional Paper No 10 of 1965 (GoK 1965) set the pace for development at the time of Kenya's independence. It gave TE the key role of developing the necessary personnel for civil service. For over two decades following independence, there was cautious expansion of TE. This expansion was driven by civil-service labour needs, rather than any idea that TE graduates might spur economic transformation. University admission was tied to the available bed spaces at the university residential halls (Oketch 2003). University of Nairobi remained the dominant institution between 1970 (when it became a fully fledged university) and 1984 (when Moi University was established). A year later, in 1985, Kenyatta College, which had been a constituent college of University of Nairobi, became an independent fully fledged university. During this period (1970-90), per-pupil expenditure on TE was high. The elite model of university dominated, with the government paying expensive room and board costs for accepted students and with most graduates preferring to look for employment in the civil service and government parastatals. Private-sector employment during this period was minimal, so it can be argued that TE primarily served the human-capital needs of government, government parastatals and a few international corporations (such as Unilever and Barclays Bank). This restricted, subsidised TE system stood in sharp contrast to high levels of illiteracy and low primary-education-enrolment rates, and amounted to a situation in which the poor subsidised the education of the better off (as the majority of Kenyans from low-income backgrounds had an extremely limited chance of accessing TE). This elite model of the university produced an extremely high personal (private) ROR for the graduates with limited externalities normally associated with expanded access to TE.

Since the 1990s, the TE sub-sector has changed dramatically, largely due to the rapid rise of private universities and fee-paying units within public universities, popularly known as 'parallel programmes' (Oketch 2009). This has led to a more demand-driven TE sub-sector, linked to the needs of the labour market, in contrast with the former supply-driven model. There has also been a shift in the emphasis on the role of university graduates in Kenya's development, due to paucity of employment opportunities within the government. This has resulted in an expansion of enrolment in demand-led higher education and accelerated emergence of private providers. However, there has been little evidence of growth in the areas of technology and science. Social science has dominated the growth and expansion so far, with commerce-related disciplines, such as bachelor of commerce degrees, actuarial science, IT and business becoming very popular degree options.

Vision 2030 (GoK 2003), being different from Sessional Paper No 10 of 1965 (which focuses on civil-service employment), clearly advocates for the role of TE in making Kenya a middle-income country by 2030. It emphasises the role of private-sector development and recognises the importance of both physical capital and human capital in Kenya's transformation.

As a result of the new focus on TE, the sub-sector has expanded rapidly in the last few years. There are currently 24 public universities, 14 of which were awarded the status of university in 2013. The older and more established universities are Nairobi (1970), Moi (1984), Kenyatta (1985), Egerton (1988), Maseno (1991), and Jomo Kenyatta University of Agriculture and Technology (1994). There are a further 23 private universities, with United States International University being the oldest (established in 1970). The majority of the other private universities, like most of the newer public universities, were established recently. There are 44 vocational/technical colleges established by the government and numerous private commercial colleges, particularly in the major centres of Nairobi, Mombasa, Kisumu and Eldoret, which specialise in basic computing skills, banking and marketing. Within the East African region, Kenya has had a liberal approach towards the expansion of TE, which has bolstered its human-capital capacity. However, like several other countries in Africa, there have been distortions in the way education has been utilised that have, in turn, impacted the potential for TE to influence development in the country.

In the TE hierarchy in Kenya, national polytechnics are considered to be one level below universities. These technical institutions are generally populated by those who do not meet the entry cut-off marks for university enrolment. They are also prestigious and, like universities, have historically been fully subsidised. Throughout much of their history, they also mainly produced technicians for the civil service. In the early years of independence, the main polytechnics were Kenya Polytechnic in Nairobi and Mombasa Polytechnic. Eldoret and Kisumu Polytechnics were later established. The former two were upgraded to full university status in 2013, reflecting the general trend in Kenya of conversion of middle-level colleges into universities. Below the polytechnics are the teacher-training colleges, which provide diplomas and certificates level, and vocational and technical colleges, populated by those who do not merit entry into the national polytechnics or the universities. Private commercial colleges, focusing primarily on commerce and technology, tend to be accessible only to youth from economically better-off families.

2. Evidence of impact in the Kenyan context

Manda et al. (2002) is one of the few empirical studies on the return to TE education in Kenya. In their analysis, they concluded that, 'The private returns to education generally increase with the level of education' (p 11). University education is reported to have the highest ROR, at slightly over 25%, compared to 7.7% for primary and 23.4% for secondary. These rates show the distortions in the labour market and the heavy subsidisation of university education in Kenya. As expected, returns in the urban areas were reported to be higher than those in rural areas, clearly indicating that it is beneficial for those with university education to work in urban areas. Indeed, in rural areas, which are mainly

agricultural, the secondary level appears to have greater returns than the tertiary level, which is an indication of the limited employment opportunities requiring TE in rural areas. The findings in Manda et al. (Ibid.) are similar to those in earlier studies (for example, Appleton 1999; Manda 1997). In general, however, there is a dearth of data related to the return to TE in Kenya. There has also not been a recent update that covers the entire labour structure. Labour-force surveys are not regular or consistent, which makes it difficult to update datasets related to interactions between the labour market and TE.

There is also a general sense that TE has provided the necessary human capital for an emerging private sector. The paucity of employment opportunities in the civil service has motivated graduates to seek employment in private industries, and home-grown conglomerates, such as Safaricom, Equity Bank and others, are examples of Kenya's economic progress that can clearly be associated with a high stock of TE-educated members of the workforce. To take a few industry examples, Kenya is known for pioneering and leading the mobile-banking industry and for making significant contributions to technological innovation at regional level. The financial sector has also grown in recent years, due to the large pool of graduates in business-related fields.

Mid-level training in vocational and technical colleges does not seem to have had such a transformative role. Statistics are not readily available, but it appears that many of those trained in public vocational and technical colleges find it difficult to obtain employment after graduation. Recent growth in the real-estate sector in major towns has seen the contribution of many of these graduates, particularly in construction skills such as plumbing, electrical work, etc. However, this is still a small sector within the Kenyan economy.

In terms of other outcomes, aside from increased earnings, it can be argued that early graduates of Kenyan TE were instrumental in establishing government institutions. More recently, however, the civil service has been associated with high levels of corruption and inefficiency. In this regard, it must be acknowledged that graduates of TE do not always have a positive impact on institutions in the Kenyan context. That being said, there has also been greater political openness in recent years, a trend that is likely to be associated with higher education externalities, similar to trends identified by Keller (2006). The Kenyan media, for example, are now much more active and independent of government interference than they have been in the past. Growth in civil society and increased participation in governance debates have occurred alongside TE expansion in the country. Multi-party elections have become more established since 2002, although it cannot be said that corruption has disappeared from Kenyan politics. The post-election violence of 2007-08 reflected the challenges faced by a country that has not managed to establish many basic structures for transparent governance, leadership and the rule of law. Since 2008, Kenya has remained in the international spotlight, because both its current president and his deputy still face allegations of crimes against humanity at the International Criminal Court (ICC) in The Hague, due to their alleged role in the post-election violence.

3. Barriers to impact in Kenya

The present focus is on a liberalised, demand-driven TE sub-sector in Kenya. Entrepreneurship is still limited, although there has been significant growth in the IT and business sectors. However, TEIs have not yet found a way to foster innovation skills, either

through teaching or research. Very few patents emerge from Kenya, and very few graduates seem to have the skills needed for agricultural innovation, technology or manufacturing. Research into how TE interacts with the labour market has also been very limited. The lack of systematic data collection has inhibited proper analysis of the inter-linkages between TE and development in the Kenyan context.

Access to TE also remains a challenge in Kenya, as less than 5% of the age cohort is currently enrolled in TE. This means that less than 10% of the overall population has a tertiary education. Like many other countries in the region, Kenya has a very young population, and youth unemployment is a major issue. The government has attempted to address it by establishing a youth fund, but this has not been satisfactorily operationalised, due to the inefficiencies and negative attitudes within the civil service, such as corruption and tribalism.

Despite these barriers, Kenya can be described as being at a crossroads in terms of its TE sub-sector. Government policy towards TE will, therefore, be crucial in order to ensure that TE can play a transformative role in Kenya's development. Expansion has been rapid, but there is still limited capacity to meet the demand for higher education, and labour-market bottlenecks remain a challenge for university graduates. Kenya adopted a new constitution in August 2010, which aimed to deliver a new Kenya, devoid of the situation that led to the 2007-08 post-election violence. The new constitution created a devolved system, meaning that Kenya now has 47 elected governors mandated with developing their regions. How this devolution is harnessed to promote and utilise TE will be an important area of study. Regional growth will require both monetary capital and human capital, and hubs of growth are expected to emerge. If this happens, it will open a new front in Kenya's development trajectory. TE has a crucial role to play, but only if the sub-sector continues to move away from an exclusive focus on training for the civil service and towards an emphasis on innovation and links with the private sector.

B. The case of Rwanda

1. TE in Rwanda

Despite Rwanda's close geographic proximity to Kenya, there are dramatic differences between the TE systems of the two East African countries. In large part, the dissimilarities between the systems are attributable to Rwanda's recent violent history. Along with an unimaginable loss of human life, the war and genocide of 1994 devastated the country's infrastructure, including its institutions of higher learning. Although tragic in every other sense, the genocide has played a crucial role in the history of TE in Rwanda for two primary reasons. First, the complete destruction of the sub-sector has allowed for the establishment of an entirely new system of public TE in Rwanda (Mazimhaka and Daniel 2003). Most public universities in the region continue to struggle to overcome the legacy of decades of neglect, outlined in Section 2 of this report. In contrast, the public TE system in Rwanda is relatively unburdened by historical challenges. Furthermore, the particular nature of the relationship between the Rwandan government and the international community has allowed for the prioritisation of support for the TE sub-sector, even in the face of competing donor pressures. For the past 20 years, the international focus on universal primary education has prevented many African

governments from providing substantial funding to their TEIs, as international donors have demanded that the majority of education funding be dedicated to the primary sub-sector. Rwanda has generally been able to resist this pressure, likely due to feelings of guilt within the international community for the lack of international interference during the events of 1994 (Hayman 2009). This dynamic has allowed the Rwandan government to maintain an unusually high level of financial support for its TEIs (Hayman 2007). In the years directly following the genocide, Rwanda justified its expenditure on TE in terms of the need to replace highly skilled human capital lost during the conflict (Mazimpaka et al. 2000, Obura et al. 2003). In recent years, the rhetoric has shifted to arguments in favour of the importance of TE in the context of the knowledge economy. As a small, land-locked country, Rwanda has very few natural resources. The government has therefore elected to model its national development strategy on the trajectory of the East Asian ‘tigers’, particularly Singapore, which relied on the education of an expanding workforce as the key to economic growth and self-reliance (Murenzi and Hughes 2006, Tikly and Great Britain Department for International Development 2003). TE is, therefore, seen to play a prominent role in the realisation of Rwanda’s development vision.

As a result of the government’s financial and rhetorical support for TE, Rwanda’s TE sub-sector has grown exponentially in recent years. The public TE sub-sector currently comprises seven universities and ten training colleges and polytechnics (Sindayigaya 2010)²⁸. There has also been a rapid expansion of private TE, with private institutions accounting for roughly half of the country’s higher-education enrolment (MINEDUC 2012). In 2011, there were 73,674 students enrolled in TEIs in Rwanda (Ibid.). Although still only 4.8% of the eligible population (World Bank 2011), student enrolments have risen by between 15% and 25% a year since 1995 (Hayman 2005; MINEDUC 2012). In addition to expanding the number of TEIs, the Rwandan government has attempted to improve access to TE by providing bursaries to students that perform particularly well in the National Examination at the end of secondary school (World Bank 2009).

2. Evidence of impact in the Rwandan context

In many ways, it is too early to determine the development impact of the Government of Rwanda’s investment in TE, as much of the expansion of the TE sub-sector has occurred in recent years. Only one study in this review investigated any macro-level impact of TE in the Rwandan context (Lassibille and Tan 2005). The analysis from this study indicates that the private ROR is much higher than the social ROR on investment in TE in Rwanda. However, the Lassibille and Tan study relies on data from 1999-2001. It seems likely that more recent data would reflect different trends, particularly given the importance of incorporating a time lag into any analysis of the impact of TE on economic growth (McMahon 1999, Tilak 2010).

There is, however, some evidence of micro-level impact within the Rwandan context. In his investigation of a USAID-funded agricultural-research partnership based at the National University of Rwanda, Collins (2012) found that the initiative had increased the productivity and earnings of local coffee farmers. Although ultimately excluded from the review due to the non-transparency of its research methodology, another study identifies

²⁸ In 2013, the Rwandan government combined the public universities into one University of Rwanda with constituent colleges, so there is, technically, now only one public university in the country.

a number of products developed at the Kigali Institute of Science & Technology (KIST), such as low-cost hand- and foot-powered water pumps, which are used to improve health and sanitation in rural areas (Butare 2004).

3. Barriers to impact in Rwanda

The situation of the TE sub-sector in Rwanda differs from the situation in many other low-income contexts. The explicit focus on TE as a national development priority has allowed for the rapid expansion of the sub-sector, resulting in a higher proportion of TE graduates in the workforce. National policies and the solicitation of targeted donor investment have attempted to diversify access to TE and increase the amount and quality of research generated within the country's TEIs. Many of the national public institutions are also in the process of developing postgraduate programmes, in an attempt to build the capacity of future academics and limit the 'brain drain' of graduates leaving the country in search of postgraduate qualifications. In addition to supporting the TE sub-sector, the Government of Rwanda has focused on improving the 'enabling environment' for TE (Palmer et al. 2007) by improving public health, ensuring high levels of public security and establishing supportive structures for the establishment of small businesses. The 2006 decision to abolish school fees for lower-secondary education has also substantially increased the national primary-school-enrolment rate. In 2011, 94.3% of boys and 97.5% of girls were enrolled in primary school in Rwanda (MINEDUC 2011), which is one of the highest primary-school-enrolment rates in the region. The combined effect of these initiatives is likely to increase the likelihood that Rwandan TE can have a positive impact on development outcomes in the future.

There are, however, barriers to impact, which are likely to operate in the Rwandan context. There is some evidence that academic quality may be a significant issue within Rwanda's TEIs. Schendel (2013), for instance, has found that students at Rwanda's public universities do not demonstrate significant improvement in critical thinking ability during their time at university. There has been little investigation of research activities within Rwanda institutions. However, there is a high likelihood that academic freedom may be limited, particularly within the public universities, given the largely dictatorial nature of the current regime.

Despite these areas of potential concern, the Rwandan situation is certainly a promising one, particularly if the government is able to sustain its financial support for the TE sub-sector. It will, therefore, be an interesting case study to follow in the years to come.



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