Study on Innovation in Higher Education

Final Report

Written by

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Luxembourg: Publications Office of the European Union, 2014

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Executive summary

Introduction

In meeting the objectives of the Europe2020 Strategy, European institutions assigned a central role to higher education. The European Commission (EC), in subsequent communications released in 2011, 2012 and 2013, stressed the importance of education – and higher education in particular – as a key enabler of smart, sustainable and inclusive growth. This study is firmly framed within this policy context, providing primary evidence on many of the themes that recent EC communications touch upon, as far as innovation in higher education is concerned. The report aims in particular to contribute to a better understanding of recent developments affecting higher education and provide evidence of how innovation can support higher education in times of change.

The study builds on four overarching research questions.

- What are the main challenges facing higher education and driving innovation in this sector?
- What are the key differences in terms of regional and institutional contexts for achieving successful innovation in higher education for different constituencies?
- How does innovation in higher education involve key system components and how does it influence – directly and indirectly – the system functions? What are the key processes and the roles of the key stakeholders in implementing innovation?
- What are the major outcomes of innovation in higher education and what main bottlenecks and blockages exist in achieving them?

In order to gather the evidence base to answer these questions, and to shed light on selected processes of innovation in the higher education sector, desk research and seven case studies have been conducted, that fall within three interconnected themes with system-wide significance and implications for all higher education stakeholders, as follows:

Case study	Theme
Innovative approaches to teaching and learning at the Olin College of Engineering (US)	The changing landscape of teaching and learning in higher education
Macro-level blended learning at the Bavaria Virtual University (Germany)	
US- originated MOOCs (Coursera, Udacity, NovoEd)	
EU-originated MOOCs (multi- and single- institution platform providers)	
The development of Learning Analytics at Purdue University (US), University of Derby (UK), and University of Amsterdam (the Netherlands)	Technology and the student performance in higher education
The eAdvisor at Arizona State University (US)	

The internationalisation strategy of the University of Nottingham (UK) and the establishment of campuses in Asia	Globalisation and multi-campus universities

Analytical framework

The project takes an innovative approach by adopting the concept of 'innovation systems' and adapting it to higher education. The analytical construct of 'higher education innovation system' has thus been developed as a sub-set of an innovation system, concentrated particularly in higher education institutions which are in close connection with other institutional spheres, such as industry, government and non-government agencies, and the society at large. A higher education innovation system can be seen as a set of functions, components and relationships, which allow us to disaggregate the various levels of interactions among the elements of the system and analyse the unfolding of innovation in higher education, as summarised below.

Higher education innovation system		
Functions	**Components**	**Relationships**
• Education • Research • Engagement ('third mission')	• Direct and indirect actors • Institutional and individual actors	• Collaboration/conflict moderation • Substitution • Networking

Using a system approach was beneficial for two main purposes:
- It allowed the project to move beyond higher education as a broad category and rather look into single elements that compose it, being able to pinpoint why, how, and what innovation takes place and who are the actors that drive (or hinder) innovation;
- It allowed the project to take a dynamic approach by looking not only at innovation within the elements described above but also at the interaction within and among components, relationships, and functions.

Case studies

Each of the seven case studies has been filtered through the higher education innovation system approach, so that the analysis highlighted in each case study the function(s) that the initiative focuses on; the relevant actors that take part in the initiative; and the relationships that are established among the actors. The seven case studies are summarised below.

> **Olin College of Engineering**
> This case study focuses on the approach to teaching and learning adopted at Olin College of Engineering. In particular, it provides an account of the college's interdisciplinary curriculum that is built around the "Olin Triangle", which includes studies in Science and Engineering, Business & Entrepreneurship, and Arts/Humanities/Social Sciences, in collaboration with two neighbouring colleges, one specialised in Business (Babson College) and one in liberal arts (Wellesley Colleges). The aim of Olin is to produce graduates who have robust technical skills, the ability to apply engineering concepts to real problems, an interdisciplinary orientation and extensive

design experience.

Bavaria Virtual University (BVU)

This case study provides an example of education-focused cooperation between state-funded universities in the German state of Bavaria. The BVU promotes and coordinates the development and implementation of tailor-made online course offerings at Bavarian universities for students (for free) and others (low fee). Online courses are developed according to "blended learning at macro level", meaning that the course (micro-level) needs to be completely online so that it can be used in the study programmes of all universities. However, the BVU does not provide a complete online study programme: study programmes (macro-level) are therefore blended, as parts are traditional face-to-face courses and others are online courses.

US-originated MOOCs

The case study focuses on Coursera, Udacity and NovoEd, all venture capital-backed education companies spun off from Stanford University offering online learning at low- or no- cost to thousands of students across the globe through partnerships with several universities. All are very young companies (Udacity was launched in January 2012, Coursera in April 2012 and NovoED in April 2013) and are founded by Stanford professors. All companies have a close connection with Stanford and the entrepreneurial and venture capital community of Silicon Valley, which had a key role in their creation and dynamic growth. The companies share a common belief in their role to bring accessible, affordable, engaging, and effective higher education to the world.

EU-originated MOOCs

The case study examines three initiatives at different stages of development: FutureLearn, OpenHPI and Leuphana. FutureLearn is a consortium-based MOOC provider based on prestigious UK and other universities partnering with world-known UK institutions (British Council, British Library and British Museum) and the UK government. It is led by a not for-profit company owned by the UK's Open University, and has been formed as a UK response to large US MOOC providers, particularly Coursera, edX and Udacity. It has high-level political support from the UK Government. By contrast, the two German cases considered are niche providers with strong regional public sector and private sector support. OpenHPI is a development of Hasso Plattner Institute (HPI) based at the University of Potsdam in Germany. Leuphana is a public university in Northern Germany and it utilised the brand of the Leuphana Digital School as a platform for its online education In January 2013.

Learning Analytics at Purdue University, the University of Derby, and the University of Amsterdam

This case study examines innovative approaches to the use of student data to inform decision-making by the use of Learning Analytics across three universities. The concrete examples are:

- Purdue University (US) has implemented Course Signals to increase student success in the classroom. Purdue University's Course Signals application detects early warning signs and provides intervention to students who may not be performing to the best of their abilities before they reach a critical point. Course Signals is easy to use, it provides real-time, frequent and ongoing feedback.

Furthermore, interventions start early - as early as the second week of class.

- The University of Derby (UK) explored the strategies to improve student enhancement processes by addressing key questions such as: (i) What is actually happening to students, how can we find out?; (ii) What are the touch points between students and the institution?; (iii) What are the institutional "digital footprints" of the students?; and (iv) What really matters to students?
- The Dutch University of Amsterdam (UvA) and the Free University of Amsterdam (VU) received a fund from SURF to conduct a pilot study on user requirements for LA. It looked into ways to use data to make visualisations to inform teachers on (i) the use of e-learning material by students; (ii) the order in which the learning material is used; and (iii) whether there is a relationship between the number of materials used and the study results.

The eAdvisor at Arizona State University (ASU)
The e-Advisor is ASU's electronic advising and degree tracking system. It uses modern technology and data analytics to help students find majors that best fit their interests and thus ensure they have the highest likelihood to graduate. The key objectives of the initiative are to increase the student retention and graduation rate, provide quality education at affordable costs to an ever increasing number of students.

The internationalisation strategy of the University of Nottingham (UK) and the establishment of campuses in Asia
This case study analyses the internationalisation strategy of the University of Nottingham which started with plans to set up two international campuses in Malaysia and China, originating in the 1990s. This innovation is seen as part of deeper and wider institutional processes: the initiatives aimed not only to make Nottingham a global university, but to transform its identity, mission and ways of working from deeply conservative to vibrant, visionary and imaginative. The initiative is seen as "deliberatively disruptive". The overall objective of establishing the two Asian campuses, in Semenyih, Malaysia in 2000, and Ningbo, China in 2004, was to create a different identity and stature for the University than could be won in the UK alone; to progressively embed an attitude of innovation and an international outlook throughout the University.

Main findings
The findings of the study are structured around the four overarching research questions and closely reflect the analytical framework adopted as backbone of the study. The main findings are summarised below:

Main challenges for higher education driving innovation
Three main challenges that the higher education sector faces across the globe and that are also driving innovation in this sector have been identified: (i) pressures from globalisation; (ii) changing supply of and demand for higher education; and (iii) changes in higher education funding. These various challenges determine the development and implementation of various innovative practices to address them. The same challenge may trigger the introduction of different innovative practices in different institutional contexts, while the same innovative practice may be simultaneously driven by more than one challenge.

Contexts for successful innovation

Successful innovative practices build on an interplay between national/regional and institutional factors. The prominence of one or another type of factor varies subject to various features, such as scope of the initiative and level of autonomy of an institution. Regarding the former, the broader the scope, the higher the influence of national/regional factors; the more limited the scope, the higher the influence of institutional factors. Regarding the latter, more autonomous higher education institutions, having more control over their financial resources and allocation of these resources to their functions, tend to develop more bottom-up practices. The direct impact of these types of innovations may be more immediate, but also more limited, often confined to the boundaries of the innovating institution. On the other hand, less autonomous higher education institutions tend to have a more top-down, state-driven approach to innovation. This does not make them less innovative, but comes to support wider-ranging relationships and processes across the higher education system and longer timescales for implementation, ensuring a longer-term and larger impact beyond institutional boundaries.

Components, functions and relationships in a higher education innovation system

The development and implementation of innovations in higher education systems have an impact on all the systems elements: components, relationships and functions. At the components level, a wide range of direct and indirect, individual and institutional actors are influenced by these innovations. At the relationships level, the most important effects are due to cooperation, networking and increased mobility, which may alter traditional relationships among actors or introduce new ones. At the functions level, the most significant impact is observed on the education function, and a more limited, but growing impact is observed on the research and engagement functions. This may be seen just as a manifestation of the early stage at which many of the innovative practices examined find themselves, rather than an effect of a minor importance of the innovation. Therefore, the impact of some innovation practices on other system functions, such as research and engagement, is likely to intensify and become more visible over time, as the innovation matures and diffuses more broadly into the higher education innovation system. Three dynamics appear to be most significant within an innovative higher education system:

- As innovation diffuses within the higher education system and touches every element of a higher education institution, the innovation process needs to be better managed. While management methodologies are taught in many universities, university managers are not trained for this, and in most cases they are promoted academics;
- There is a reciprocal nature of change within an innovative higher education system: the system elements (components, relationships and functions) have an impact on the success of the innovation, while the success of the innovation induces further changes in the system elements. A spiral of change is thus created within the higher education system to make it more responsive to environmental changes;
- The change induced in a higher education innovation system by the innovative practices examined in the study is not of a radical nature, but is rather slow and incremental. Many innovation practices do not radically modify the traditional Higher education institutions' functions; rather, they provide new ways of doing traditional things that that respond more efficiently to changing requirements in higher education.

Outcomes and blockages

Four main outcomes of innovation in higher education emerge: (i) the vision behind and the use of new technologies represent enablers of innovative practices, rather than innovations per se; (ii) the use of new technologies appears to be a facilitator of the transition from a

department-centred vision to a student-centred vision of education; (iii) innovation often stimulates an accelerated development of partnerships between Higher education institutions and other organisations, especially businesses; (iv) innovations in higher education illustrate well two general key aspects of the innovation process: 'doing new things' and 'doing existing things better'.

The blockages for innovation can be found both at the institutional -level, such as the lack of institutional support for innovative practices and at national/regional, for example influenced by different degrees of autonomy of higher education institutions. Regulatory frameworks are also a crucial potential blockage to some innovative practices. Notwithstanding these blockages, innovative practices do show the potential for delivering high-quality and equitable outcomes, in terms of widening access to higher education, granting students a more central role within the system, and providing potential pathways to cope with the financial pressures that affect the system.

Policy recommendations

Policy recommendations are clustered around the three central themes identified through the study and focus on two particular target groups, higher education institutions and policy-makers.

Policy recommendations related to the changing landscape of teaching and learning in higher education

Higher education institutions should consider the need to:
- Nurture an institutional culture to innovation that enhances creativity, creates awareness of the benefits resulting from the implementation of the innovation, stimulates openness to innovation and minimises resistance to change
- Consider incentives and rewards for members of staff (including but not limited to academics) who engage in innovative practices
- Engage faculty members in exploiting the potential of new learning technologies
- Consider the use of cross-institutional collaboration to improve student choice and quality (and possibly cut costs)
- Put in place adequate measures for skills development of teaching staff and also for greater collaboration in performing their teaching duties
- Review existing organisational boundaries and linkages

Policy-makers should consider the need to:
- Establish a clear regulatory framework that addresses blockages that some developments in online learning are faced with today, including: inappropriate quality assurance mechanisms, the lack of credit recognition processes and intellectual property right regulations

Policy recommendations related to technology and student performance in higher education

Higher education institutions should consider the need to:

- Identify the (diverse) needs and circumstances of the learners;
- Ensure learner access to relevant technologies and possession of necessary skills to gain maximum benefits from them;
- Recognise that the successful introduction of learning analytics will be dependent not only on the choice of technology but on making the institutional changes necessary so that teachers, IT staff and administrators work effectively together to support students.
- Provide appropriate processes, tools and support activities so that Faculty are able to fully utilise the rich data generated through analytics to enable them to respond to individual student needs and to further develop their teaching.
- Clarify the roles of the different actors (within and beyond the institution) involved in meeting these needs;
- Ensure a collective understanding of the different roles/responsibilities and the relationships between them
- Ensure clear lines of management responsibility and information requirements to assess performance
- Build supportive relationships and trust between the relevant actors (students, academic staff, support staff, IT staff, managers and, where applicable, employers)

Policy-makers should consider the need to:
- Clarify the funding implications, intended outcomes and timescales for the innovation
- Collect and analyse feedback information (from learners, institutions, employers etc) on performance and impact, and inform all relevant actors
- Identify any unintended consequences of the innovation (e.g. for other functions, for widening participation or labour market linkages)

Policy recommendations related to globalisation and internationalisation strategies

Higher education institutions should consider the need to:
- Balance commercial, educational and reputational considerations in formulating overall international strategy
- Address a range of interconnected factors such as student mobility (inward and outward), student placements, qualification recognition, funding implications, curriculum and pedagogic implications, and labour market linkages
- Consider the needs of different actors including home and international students, academic and support staff, quality assurance agencies, employers and sponsoring bodies
- Engage 'home' staff and to build relationships between staff located at the different campuses
- Establish how much to 'export' from the home institution and how much to build to reflect local contextual factors at different campuses
- Establish how much to 'import' from the international activities to reshape the home institution
- Satisfy different national regulatory and quality assurance regimes

Policy-makers should consider the need to:

- Provide support for inward and outward mobility of students

Résumé

Introduction

Pour atteindre les objectifs de la stratégie Europe 2020, les institutions européennes ont attribué un rôle central à l'enseignement supérieur. Dans des communications ultérieures publiées en 2011, 2012 et 2013, la Commission européenne (CE) a souligné l'importance de l'éducation – et de l'enseignement supérieur en particulier – comme facteur clé de la croissance intelligente, durable et inclusive. Cette étude s'inscrit fermement dans ce contexte politique, fournissant des preuves primaires sur la plupart des thèmes touchant à l'innovation dans l'enseignement supérieur abordés dans les récentes communications de la CE. Le rapport vise en particulier à contribuer à une meilleure compréhension des évolutions récentes observées dans le secteur de l'enseignement supérieur et à fournir des preuves de la façon dont l'innovation peut soutenir l'enseignement supérieur dans une ère de changement.

L'étude s'articule autour de quatre questions générales de recherche.

- Quels sont les principaux défis de l'enseignement supérieur et de la promotion de l'innovation dans ce secteur ?
- Quelles sont les principales différences en termes de contextes régionaux et institutionnels pour la réalisation d'une innovation réussie dans l'enseignement supérieur pour les différents groupes d'intérêt ?
- Dans quelle mesure l'innovation dans l'enseignement supérieur implique-t-elle les principaux composants du système et comment influence-t-elle – directement et indirectement – les fonctions du système ? Quels sont les processus clés et les rôles des acteurs clés dans la mise en œuvre de l'innovation ?
- Quels sont les principaux résultats de l'innovation dans l'enseignement supérieur et quels principaux goulets d'étranglement et blocages se dressent sur le chemin pour l'atteindre ?

Afin de recueillir des données probantes pour répondre à ces questions et, pour faire la lumière sur les processus d'innovation sélectionnés dans le secteur de l'enseignement supérieur, une recherche documentaire et sept études de cas ont été réalisées. Elles couvrent trois thèmes étroitement liés ayant une signification et des implications à l'échelle du système pour toutes les parties prenantes de l'enseignement supérieur, comme suit :

Étude de cas	Thème
Des approches novatrices à l'enseignement et à l'apprentissage au Olin College of Engineering (États-Unis)	Le paysage changeant de l'enseignement et de l'apprentissage dans l'enseignement supérieur
L'apprentissage mixte au niveau général à la Bavaria Virtual University (Allemagne)	
Les MOOC proposés depuis les États-Unis (Coursera, Udacity, NovoEd)	
Les MOOC proposés depuis l'UE (fournisseurs de plateforme à des institutions uniques et multiples)	

Le développement de l'analyse de l'apprentissage à l'université Purdue (États-Unis), à l'université de Derby (Royaume-Uni) et à l'université d'Amsterdam (Pays-Bas)	La technologie et les performances des étudiants dans l'enseignement supérieur
L'eAdvisor à l'Arizona State University (États-Unis)	
La stratégie d'internationalisation de l'université de Nottingham (Royaume-Uni) et la mise en place de campus en Asie	La mondialisation et les universités multi-campus

Cadre analytique

Le projet s'engage dans une approche novatrice en adoptant le concept de « systèmes d'innovation » qu'il adapte à l'enseignement supérieur. La structure analytique du « système d'innovation dans l'enseignement supérieur » a donc été conçue comme un sous-ensemble d'un système d'innovation, concentré en particulier dans les établissements d'enseignement supérieur en étroite relation avec d'autres domaines institutionnels, tels que l'industrie, les organismes gouvernementaux et non gouvernementaux et la société en général. Un système d'innovation dans l'enseignement supérieur peut être perçu comme un ensemble de fonctions, de composantes et de relations, qui nous permettent de ventiler les différents niveaux d'interactions entre les éléments du système et d'analyser le déroulement de l'innovation dans l'enseignement supérieur, tel que résumé ci-dessous.

Système d'innovation dans l'enseignement supérieur		
Fonctions	**Composantes**	**Relations**
• Éducation • Recherche • Engagement (« troisième mission »)	• Acteurs directs et indirects • Acteurs institutionnels et individuels	• Collaboration/modération de conflits • Substitution • Réseau

Le recours à une approche de système s'est avéré bénéfique pour deux raisons principales :
- il a permis au projet d'aller au-delà de l'enseignement supérieur en tant que vaste catégorie et de se pencher plutôt sur des éléments individuels qui le composent, en étant en mesure de déterminer pourquoi, comment et quelle innovation a lieu mais également les acteurs qui l'animent (ou l'entravent) ;
- il a permis au projet d'adopter une approche dynamique en examinant non seulement l'innovation dans les éléments décrits ci-dessus, mais également l'interaction au sein et entre les composantes, les relations et les fonctions.

Études de cas

Chacune des sept études de cas a été filtrée à l'aide de l'approche du système d'innovation dans l'enseignement supérieur. En conséquence, l'analyse a mis en évidence dans chaque étude de cas, la ou les fonction(s) sur la ou lesquelles l'initiative met l'accent : les acteurs concernés qui participent à l'initiative et les relations nouées entre les acteurs. Les sept études de cas sont résumées ci-dessous.

Olin College of Engineering

Cette étude de cas porte sur l'approche de l'enseignement et de l'apprentissage adoptée à Olin College of Engineering. De manière spécifique, elle présente le programme interdisciplinaire de l'université qui est construit autour du « Olin Triangle », qui comprend les études en sciences et en ingénierie, les entreprises et l'entreprenariat et les arts, sciences humaines et sociales, en collaboration avec deux universités voisines, une spécialisée en entreprises (Babson College) et une en arts libéraux (Wellesley Colleges). Le but d'Olin est de produire des diplômés dotés de compétences techniques solides, de la capacité d'appliquer les concepts d'ingénierie à des problèmes réels, d'une orientation interdisciplinaire et d'une vaste expérience de la conception.

Bavaria Virtual University (BVU)

Cette étude de cas illustre la coopération axée sur l'éducation entre les universités financées par l'État dans le Land allemand de Bavière. La BVU favorise et coordonne l'élaboration et la mise en œuvre de l'offre de cours sur mesure en ligne dans les universités bavaroises à l'intention des étudiants (sans frais) et d'autres (à coût réduit). Les cours en ligne sont développés selon l'« apprentissage mixte au niveau général », ce qui signifie que le cours (au niveau spécialisé) doit être entièrement en ligne de sorte qu'il puisse être utilisé dans les programmes d'études de toutes les universités. Cependant, la BVU ne fournit pas un programme d'études complet en ligne : les programmes d'études (au niveau général) sont donc mixtes, avec des parties des cours traditionnels en face-à-face et d'autres cours en ligne.

MOOC proposés depuis les États-Unis

L'étude de cas porte sur Coursera, Udacity et NovoEd, toutes les entreprises d'éducation financées par du capital-risque issues d'un essaimage de Stanford University offrant l'apprentissage en ligne à faible coût ou sans frais à des milliers d'étudiants à travers le monde grâce à des partenariats avec plusieurs universités. Il s'agit toutes de très jeunes entreprises (Udacity a été lancé en janvier 2012, Coursera en avril 2012 et NovoED en avril 2013) et ont été fondées par des professeurs de Stanford. Toutes les entreprises ont un lien étroit avec Stanford et la communauté entrepreneuriale et du capital-risque de la Silicon Valley, qui a joué un rôle clé dans la création et la croissance dynamique. Les entreprises partagent une croyance commune dans leur rôle d'offrir au monde un enseignement supérieur accessible, abordable, attrayant et efficace.

MOOC proposés depuis l'UE

L'étude de cas porte sur trois initiatives à différents stades de développement : FutureLearn, OpenHPI et Leuphana. FutureLearn est un fournisseur de MOOC en consortium basé dans des universités prestigieuses de Grande-Bretagne et d'autres en partenariat avec des institutions britanniques de renommée mondiale (British Council, British Library et British Museum) et le gouvernement du Royaume-Uni. Il est dirigé par une société à but non lucratif appartenant à l'Open University du Royaume-Uni et a été créé comme une réponse du Royaume-Uni aux grands fournisseurs de MOOC des États-Unis, en particulier Coursera, edX et Udacity. Il bénéficie du soutien politique de haut niveau du gouvernement britannique. En revanche, les deux cas allemands étudiés sont des fournisseurs de niche bénéficiant d'un fort soutien du secteur public et du secteur privé régionaux. OpenHPI est un développement de Hasso Plattner Institute (HPI), basé

à l'université de Potsdam en Allemagne. Leuphana est une université publique du nord de l'Allemagne et il a utilisé la marque de la Leuphana Digital School comme plateforme pour son enseignement en ligne en janvier 2013.

L'analyse de l'apprentissage à Purdue University, University of Derby et University of Amsterdam
Cette étude de cas examine les approches novatrices de l'utilisation de données sur les étudiants pour éclairer la prise de décisions par l'utilisation de l'analyse d'apprentissage dans les trois universités. Les exemples concrets sont les suivants :

- Purdue University (États-Unis) a mis en place des signaux de cours pour augmenter la réussite des étudiants dans la salle de classe. Les signaux de cours de Purdue University détectent les signes d'alerte précoce et fournissent une intervention aux étudiants qui n'arrivent pas à exploiter au mieux leurs capacités avant de se retrouver dans une situation critique. Les signaux de cours sont facile à utiliser et fournissent en temps réel une rétroaction fréquente et continue. En outre, les interventions commencent tôt - dès la deuxième semaine de cours.
- La University of Derby (Royaume-Uni) a étudié les stratégies visant à renforcer les processus d'amélioration des étudiants en abordant des questions clés telles que : (i) Qu'est-ce qui se passe réellement chez les étudiants, comment pouvons-nous savoir ? (ii) Quels sont les points de contact entre les étudiants et l'institution ? (iii) Quelles sont les « empreintes numériques » institutionnelles des étudiants ? Et (iv) qu'est-ce qui compte vraiment pour les étudiants ?
- La Dutch University of Amsterdam (UvA) et la Free University of Amsterdam (VU) ont bénéficié d'un fonds de SURF pour mener une étude pilote sur les besoins des utilisateurs pour LA. Elle a passé en revue les façons d'utiliser les données pour concevoir des visualisations destinées à informer les enseignants sur (i) l'utilisation du matériel didactique par les étudiants, (ii) l'ordre dans lequel le matériel didactique est utilisé, et (iii) s'il existe un lien entre le nombre de matériels utilisés et les résultats de l'étude.

L'eAdvisor de l'Arizona State University (ASU)
L'eAdvisor est le système électronique de conseil et de suivi des diplômes de l'ASU. Il utilise les technologies modernes et l'analyse de données pour aider les étudiants à choisir les spécialisations qui correspondent le mieux à leurs intérêts et ainsi s'assurer qu'ils ont la plus forte probabilité d'obtenir leur diplôme. Les principaux objectifs de l'initiative sont : accroître la persévérance estudiantine et le taux d'obtention du diplôme, dispenser un enseignement de qualité à des coûts abordables à un nombre toujours croissant d'étudiants.

La stratégie d'internationalisation de l'université de Nottingham (Royaume-Uni) et la mise en place de campus en Asie
Cette étude de cas analyse la stratégie d'internationalisation de l'université de Nottingham qui a entamé la mise en œuvre de plans visant à créer deux campus internationaux en Malaisie et en Chine, depuis les années 1990. Cette innovation est considérée comme faisant partie de processus institutionnels plus profonds et plus vastes : les initiatives visaient non seulement à faire de l'université de Nottingham une université mondiale, mais de transformer son identité, sa mission et ses méthodes de

travail profondément conservatrices en vue d'en faire une institution dynamique, visionnaire et imaginative. L'initiative est considérée comme « délibérément perturbatrice ». L'objectif global de l'établissement des deux campus de l'Asie, à Semenyih en Malaisie en 2000 et à Ningbo en Chine en 2004, était de créer une identité et une stature différentes de l'université qu'il est impossible d'obtenir au Royaume-Uni uniquement. Il s'agit d'intégrer progressivement une attitude d'innovation et une perspective internationale dans toute l'université.

Principales conclusions

Les résultats de l'étude s'articulent autour des quatre questions générales de recherche et reflètent étroitement le cadre analytique adopté comme épine dorsale de l'étude. Les principaux résultats sont résumés ci-dessous :

Principaux défis auxquels est confronté l'enseignement supérieur dans la conduite de l'innovation

Trois principaux défis auxquels le secteur de l'enseignement supérieur est confronté à travers le monde et qui sont également des vecteurs d'innovation dans ce secteur ont été identifiés : (i) les pressions de la mondialisation, (ii) l'évolution de l'offre et de la demande pour l'enseignement supérieur et (iii) les changements dans le financement de l'enseignement supérieur. Ces différents défis déterminent le développement et la mise en œuvre de diverses pratiques innovantes pour y faire face. Le même défi peut déclencher la mise en place de diverses pratiques innovantes dans différents contextes institutionnels, tandis que la même pratique innovante peut être entraînée simultanément par plus d'un défi.

Contextes d'innovation réussie

Les pratiques innovantes réussies s'appuient sur une interaction entre les facteurs nationaux/régionaux et institutionnels. L'importance de l'un ou l'autre type de facteur varie selon diverses caractéristiques, telles que la portée de l'initiative et le niveau d'autonomie d'une institution. En ce qui concerne le premier, plus le champ d'application est large, plus l'influence de facteurs nationaux/régionaux se fait ressentir. Plus le champ d'application est limité, plus l'influence des facteurs institutionnels se fait ressentir. En ce qui concerne le dernier, des établissements d'enseignement supérieur jouissant d'une plus grande autonomie, disposant de plus de contrôle sur leurs ressources financières et d'allocation de ces ressources à leurs fonctions, ont tendance à développer des pratiques plus ascendantes. L'impact direct de ces types d'innovations peut être plus immédiat, mais également plus limité, souvent confiné aux limites de l'institution innovante. D'autre part, les institutions d'enseignement supérieur moins autonomes ont tendance à avoir une approche descendante de l'innovation menée par l'État. Cela ne les rend pas moins novatrices, mais vient à l'appui d'un champ d'application plus large des relations et des processus au sein du système d'enseignement supérieur et des échéances plus longues pour la mise en œuvre, en assurant un impact à plus long terme et plus grand au-delà des frontières institutionnelles.

Composantes, fonctions et relations dans un système d'innovation dans l'enseignement supérieur

Le développement et la mise en œuvre des innovations dans les systèmes d'enseignement supérieur ont un impact sur tous les éléments des systèmes : les composantes, les relations et les fonctions. Au niveau des composantes, un large éventail d'acteurs directs et indirects, particuliers et institutionnels, sont influencés par ces innovations. Au niveau des relations, les

effets les plus importants sont dus à la coopération, la mise en réseau et la mobilité accrue, ce qui peut modifier les relations traditionnelles entre les acteurs ou en introduire de nouvelles. Au niveau des fonctions, l'impact le plus important est observé sur la fonction de l'éducation et un impact plus limité, mais croissant, est observé sur les fonctions de recherche et d'engagement. Cela peut être considéré comme une manifestation de la première phase au cours de laquelle un grand nombre de pratiques innovantes examinées se retrouvent, plutôt qu'un effet d'importance mineure de l'innovation. Par conséquent, l'impact de certaines pratiques d'innovation sur les autres fonctions du système, telles que la recherche et l'engagement, est susceptible de s'intensifier et de devenir plus visible au fil du temps, à mesure que l'innovation se développe et se diffuse plus largement dans le système d'innovation dans l'enseignement supérieur. Trois dynamiques semblent être les plus importantes dans un système d'innovation dans l'enseignement supérieur :

- À mesure que l'innovation se diffuse dans le système d'enseignement supérieur et touche chaque élément d'un établissement d'enseignement supérieur, le processus d'innovation doit être mieux géré. Bien que les méthodes de gestion sont enseignées dans de nombreuses universités, les gestionnaires de l'université ne sont pas formés pour cela et, dans la plupart des cas, ils sont promus universitaires ;
- Il existe un caractère réciproque de changement au sein d'un système d'enseignement supérieur innovant : les éléments du système (composantes, relations et fonctions) ont un impact sur la réussite de l'innovation, tandis que la réussite de l'innovation induit d'autres changements dans les éléments du système. Une spirale de changement est ainsi créée au sein du système de l'enseignement supérieur pour le rendre plus sensible aux mutations de l'environnement ;
- Le changement induit dans un système d'innovation dans l'enseignement supérieur par les pratiques novatrices examinées dans l'étude n'est pas radical par nature, mais plutôt lent et progressif. Beaucoup de pratiques innovantes ne modifient pas radicalement les fonctions traditionnelles des établissements d'enseignement supérieur, mais elles offrent plutôt de nouvelles façons de faire les choses de manière traditionnelle qui répondent plus efficacement à l'évolution des besoins dans l'enseignement supérieur.

Résultats et blocages

Quatre principaux résultats de l'innovation dans l'enseignement supérieur se dégagent : (i) la vision sous-jacente et l'utilisation des nouvelles technologies représentent des facilitateurs de pratiques innovantes, plutôt que les innovations en elles-mêmes, (ii) l'utilisation des nouvelles technologies semble être un facilitateur de la transition d'une vision centrée sur le département vers une vision centrée sur l'étudiant, (iii) l'innovation stimule souvent un développement accéléré des partenariats entre les établissements d'enseignement supérieur et d'autres organisations, en particulier les entreprises, (iv) les innovations dans l'enseignement supérieur illustrent ainsi deux aspects principaux généraux du processus d'innovation : « faire de nouvelles choses » et « mieux faire les choses existantes ».

Les blocages à l'innovation peuvent être trouvés à la fois au niveau institutionnel, notamment le manque de soutien institutionnel pour les pratiques innovantes et au niveau national/régional, par exemple sous l'influence de différents degrés d'autonomie des établissements d'enseignement supérieur. Les cadres réglementaires représentent également un blocage potentiel crucial pour certaines pratiques innovantes. Malgré ces blocages, les pratiques innovantes affichent effectivement le potentiel pour obtenir des résultats de haute

qualité et équitables, en termes d'élargissement de l'accès à l'enseignement supérieur, d'octroi aux étudiants d'un rôle plus central au sein du système et de fourniture des voies possibles pour faire face aux pressions financières qui affectent le système.

Recommandations de politique

Les recommandations de politique sont regroupées autour de trois thèmes centraux identifiés par l'étude et l'accent sur deux groupes cibles particuliers : les établissements d'enseignement supérieur et les décideurs.

Recommandations de politique relatives à l'évolution du paysage de l'enseignement et à l'apprentissage dans l'enseignement supérieur

Les établissements d'enseignement supérieur devraient envisager la nécessité de :
- Favoriser une culture institutionnelle de l'innovation qui favorise la créativité, sensibilise aux avantages résultant de la mise en œuvre de l'innovation, stimule l'ouverture à l'innovation et réduit la résistance au changement ;
- Envisager des mesures incitatives et des récompenses pour les membres du personnel (y compris, notamment, à des universitaires) qui se livrent à des pratiques innovantes ;
- Engager les membres du corps professoral à exploiter le potentiel des nouvelles technologies d'apprentissage ;
- Envisager l'utilisation de la collaboration inter-institutionnelle pour améliorer le choix offert à l'étudiant et la qualité (et éventuellement réduire les coûts) ;
- Mettre en place des mesures adéquates pour le développement des compétences du personnel enseignant et également pour une plus grande collaboration dans l'accomplissement de leurs tâches d'enseignement ;
- Réviser les limites et liens organisationnels existants.

Les décideurs politiques devraient envisager la nécessité de :
- Mettre en place un cadre réglementaire clair visant à lever les blocages auxquels certains développements dans l'apprentissage en ligne sont confrontés aujourd'hui, y compris : les mécanismes d'assurance qualité inappropriés, l'absence de processus de reconnaissance de crédit et de règlementation sur les droits de propriété intellectuelle.

Les recommandations de politique liées à la technologie et à la performance des étudiants dans l'enseignement supérieur

Les établissements d'enseignement supérieur devraient envisager la nécessité de :
- Identifier les besoins (divers) et les conditions des apprenants ;
- Assurer l'accès des apprenants aux technologies pertinentes et la possession des compétences nécessaires pour en tirer le maximum d'avantages ;
- Reconnaître que l'introduction réussie de l'analyse d'apprentissage dépendra non seulement du choix de la technologie, mais de l'engagement des changements institutionnels nécessaires afin que les enseignants, le personnel informatique et les administrateurs travaillent efficacement ensemble pour soutenir les étudiants ;

- Fournir des processus, des outils et des activités de soutien afin que le corps enseignant soit en mesure d'utiliser pleinement les données riches générées par l'analyse pour lui permettre de répondre aux besoins individuels des étudiants et pour développer davantage son enseignement ;
- Clarifier les rôles des différents acteurs (à l'intérieur et au-delà de l'institution) impliqués dans la satisfaction de ces besoins ;
- Assurer une compréhension collective des différents rôles/responsabilités et les relations entre eux ;
- Assurer des hiérarchies claires de responsabilité de gestion et des exigences d'information pour évaluer les performances ;
- Bâtir des relations de soutien et de confiance entre les acteurs concernés (les étudiants, le personnel enseignant, le personnel de soutien, le personnel informatique, les gestionnaires et, le cas échéant, les employeurs).

Les décideurs politiques devraient envisager la nécessité de :
- Clarifier les implications de financement, les résultats escomptés et les délais pour l'innovation ;
- Recueillir et analyser les rétroactions (apprenants, institutions, employeurs, etc.) sur les performances et l'impact et informer tous les acteurs concernés ;
- Identifier les conséquences involontaires de l'innovation (par exemple pour d'autres fonctions, pour élargir la participation ou les liens avec le marché du travail).

Les recommandations politiques relatives aux stratégies de mondialisation et d'internationalisation

Les établissements d'enseignement supérieur devraient envisager la nécessité de :
- Équilibrer les considérations commerciales, éducatives et de réputation dans la formulation de la stratégie internationale globale ;
- Répondre à un éventail de facteurs interdépendants tels que la mobilité (intérieure et extérieure) des étudiants, les stages d'étudiants, la reconnaissance des qualifications, les implications financières, les programmes et les implications pédagogiques et liens avec le marché du travail ;
- Tenir compte des besoins des différents acteurs, y compris des étudiants nationaux et internationaux, du personnel enseignant et de soutien, des organismes d'assurance qualité, des employeurs et des organismes de parrainage ;
- Engager du personnel « local » et établir des relations entre le personnel basé sur les différents campus ;
- Déterminer ce qui peut être « exporté » de l'établissement d'origine et le volume de construction à réaliser afin de tenir compte des facteurs contextuels locaux sur différents campus ;
- Déterminer ce qui peut être « importé » des activités internationales pour remodeler l'institution d'accueil ;
- Satisfaire les différents régimes de réglementation et d'assurance qualité nationaux.

Les décideurs politiques devraient envisager la nécessité de :
- Fournir un appui pour la mobilité entrante et sortante des étudiants.

Zusammenfassung

Einleitung

Die europäischen Institutionen schreiben der Hochschulbildung bei der Erreichung der Ziele der Strategie Europa 2020 eine zentrale Bedeutung zu. In ihren Publikationen der Jahre 2011, 2012 und 2013 hob die Europäische Kommission die Wichtigkeit der Bildung, insbesondere der Hochschulbildung, als Grundvoraussetzung für intelligentes, nachhaltiges und integratives Wachstum hervor. Die vorliegende Studie ist fest in diesen politischen Kontext eingebettet und bietet Belege zu vielen in aktuellen Publikationen der Kommission angesprochenen Themenbereichen rund um Innovationen in der Hochschulbildung. Der Bericht soll insbesondere zum besseren Verständnis der Auswirkungen aktueller Entwicklungen auf die Hochschulbildung beitragen und aufzeigen, inwiefern Neuerungen die Hochschulbildung in Zeiten des Wandels unterstützen können.

Die Studie widmet sich vier übergeordneten Forschungsfragen.

- Was sind die größten Herausforderungen, wenn es um Hochschulbildung und die Förderung von Innovationen in diesem Bereich geht?
- Welche Hauptunterschiede gibt es im regionalen und institutionellen Kontext bei der Erreichung erfolgreicher Neuerungen in der Hochschulbildung?
- Welchen Einfluss haben wichtige Systemkomponenten auf Innovationen in der Hochschulbildung und wie wirkt sich das – direkt und indirekt – auf Systemfunktionen aus? Was sind die wichtigsten Prozesse und die Rollen der wichtigsten Interessenvertreter bei der Umsetzung von Innovationen?
- Was sind die Hauptresultate, die durch Innovationen im Hochschulwesen erzielt wurden, und welche Hindernisse können sich diesen entgegenstellen?

Um die Belegbasis zur Beantwortung dieser Fragen zusammenzustellen und ausgewählte Innovationsprozesse im Bereich Hochschulbildung näher zu beleuchten, wurde auf Sekundärforschung zurückgegriffen und es wurden sieben Fallstudien durchgeführt, die sich in der folgenden Weise mit drei ineinandergreifenden Themenbereichen mit systemübergreifender Bedeutung und den Auswirkungen auf alle Interessenvertreter in der Hochschulbildung befassen:

Fallstudie	Thema
Innovative Herangehensweisen an Lehre und Lernen am Olin College of Engineering (US)	Das sich verändernde Umfeld von Lehre und Lernen in der Hochschulbildung
Kombiniertes Lernen auf Makroebene an der Virtuellen Hochschule Bayern (Deutschland)	
MOOCs aus den USA (Coursera, Udacity, NovoEd)	
MOOCs aus der EU (Plattformanbieter für mehrere und einzelne Institutionen)	
Die Entwicklung von Lernanalysen an der Purdue University (US), University of Derby (UK) und	Technologie und Studienleistung in der

Universiteit van Amsterdam (Niederlande)	Hochschulbildung
Der eAdvisor an der Arizona State University (US)	
Die Internationalisierungsstrategie der University of Nottingham (UK) und die Errichtung von Universitäten in Asien	Globalisierung und Multi-Campus-Universitäten

Analytischer Rahmen

Dieses Projekt zeigt eine innovative Herangehensweise – das Konzept „Innovationssysteme" wird auf die Hochschulbildung angewandt. So wurde das analytische Konstrukt eines „Hochschulbildungsinnovationssystems" als Unterbereich eines Innovationssystems entwickelt. Dieses findet sich hauptsächlich in Hochschulinstitutionen, die in enger Verbindung mit anderen institutionellen Bereichen wie der Industrie, Regierungs- und Nichtregierungsbehörden und der Gesellschaft als Ganzes stehen. Ein Hochschulbildungsinnovationssystem kann als Menge von Funktionen, Komponenten und Beziehungen gesehen werden, wodurch es möglich wird, die verschiedenen Interaktionsebenen zwischen den Elementen des Systems voneinander zu trennen und die Entfaltung von Innovation in der Hochschulbildung wie in der nachfolgenden Aufstellung gezeigt zu analysieren.

Hochschulbildungsinnovationssystem		
Funktionen	**Komponenten**	**Beziehungen**
• Bildung • Forschung • Gesellschaftliche Verantwortung („Third Mission")	• Direkte und indirekte Akteure • Institutionelle und private Akteure	• Zusammenarbeit/Konfliktmoderation • Austausch • Bildung von Netzwerken

Die Anwendung eines systemischen Ansatzes hatte zwei große Vorteile:
- Das Projekt konnte so das allgemeine Konzept Hochschulbildung hinter sich lassen und auf einzelne, konstituierende Elemente eingehen und damit klar herausstellen, wieso und wie Innovation stattfindet und welcher Art diese ist, außerdem, welche Akteure Innovation vorantreiben (oder auch behindern).
- Das Projekt verfolgte also einen dynamischen Ansatz, indem nicht nur Innovation innerhalb der beschriebenen Elemente betrachtet wurde, sondern auch die Interaktion innerhalb und zwischen verschiedenen Komponenten, Beziehungen und Funktionen.

Fallstudien

Alle sieben Fallstudien wurden anhand des Hochschulbildungsinnovationssystemansatzes beurteilt, sodass für jede Studie die Funktion/-en, auf die sich die Initiative konzentrierte, die teilnehmenden Akteure und die Beziehungen, die zwischen den Akteuren aufgebaut wurden, herausgestellt werden konnten. Die sieben Fallstudien werden im Folgenden zusammengefasst.

Olin College of Engineering

Diese Fallstudie untersucht den Lehr- und Lernansatz des Olin College of Engineering. Insbesondere wird der interdisziplinäre Lehrplan des College rund um das „Olin Triangle" dargestellt, das in Zusammenarbeit mit zwei benachbarten Universitäten (das auf Wirtschaft spezialisierte Babson College und das auf freie Künste spezialisierte Wellesley College) Fächer aus Natur- und Ingenieurswissenschaften, Wirtschaft und Betriebslehre sowie Kunst/Geistes- und Sozialwissenschaften anbietet. Das Ziel des Olin College ist die Bereitstellung einer Ausbildung, die ein fundiertes Fachwissen in Technik, die Fähigkeit, Ingenieurskonzepte auf echte Probleme anzuwenden, eine interdisziplinäre Ausrichtung und umfassende Erfahrung in Design vermittelt.

Virtuelle Hochschule Bayern (VHB)

Diese Fallstudie beleuchtet ein Beispiel für eine bildungsorientierte Kooperation zwischen staatlich betriebenen Universitäten in Bayern. Die VHB fördert und koordiniert die Entwicklung und den Einsatz von bedarfsgerechten Online-Lehrangeboten an bayrischen Universitäten für Studierende (kostenlos) und andere (gegen eine geringe Gebühr). Die Onlinekurse werden anhand des „kombinierten Lernens auf Makroebene" entwickelt, d. h. dass der Kurs (Mikroebene) online abgeschlossen werden muss, damit er in den Studiengängen aller Universitäten genutzt werden kann. Die VHB bietet jedoch keinen vollständigen Online-Studiengang: In den Studiengängen (Makroebene) werden die üblichen Kurse vor Ort mit Onlinekursen kombiniert.

MOOCs aus den USA

Die Fallstudie befasst sich mit Coursera, Udacity und NovoEd, Bildungsunternehmen mit Beteiligungskapital, die aus der Stanford University hervorgegangen sind. Sie bieten Onlinekurse zu niedrigen Preisen bzw. kostenlos, die dank Partnerschaften mit verschiedenen Universitäten von tausenden von Studierenden auf der ganzen Welt genutzt werden. Alle drei Unternehmen sind noch jung (Udacity wurde im Januar 2012 gegründet, Coursera im April 2012 und NovoEd im April 2013) und wurden von Professorinnen und Professoren der Stanford University gegründet. Sie sind daher eng mit Stanford und dem Unternehmens- und Beteiligungskapital von Silicon Valley verbunden, was großen Einfluss auf ihre Erschaffung und ihr dynamisches Wachstum hatte. Die Unternehmen sind davon überzeugt, dass sie dazu beitragen können, zugängliche, kostengünstige, motivierende und effiziente Hochschulbildung an die ganze Welt zu vermitteln.

MOOCs aus der EU

In dieser Fallstudie werden drei Initiativen in unterschiedlichen Entwicklungsstadien untersucht: FutureLearn, OpenHPI und Leuphana. FutureLearn ist ein genossenschaftsbasierter MOOC-Anbieter auf Grundlage angesehener Universitäten im Vereinigten Königreich und anderen Ländern in Partnerschaft mit weltbekannten hiesigen Institutionen (British Council, British Library und British Museum) und der britischen Regierung. Die Leitung übernimmt eine gemeinnützige Gesellschaft im Besitz der britischen Open University. FutureLearn ist die Antwort des Vereinigten Königreichs auf die großen MOOC-Anbieter in den USA, insbesondere Coursera, edX und Udacity. Es besteht Unterstützung von höchster Ebene: der Regierung des Vereinigten Königreichs. Im Gegensatz dazu sind die zwei deutschen Fälle eher Nischenanbieter mit starker Unterstützung der Regionen und der Privatwirtschaft. OpenHPI ist eine Entwicklung des Hasso-Plattner-Instituts (HPI) der Universität Potsdam. Leuphana ist eine öffentliche

Universität in Norddeutschland und nutzt seit Januar 2013 die Marke Leuphana Digital School als Plattform für ihr Online-Lehrangebot.

Lernanalysen an der Purdue University, University of Derby und Universiteit van Amsterdam

In dieser Fallstudie werden innovative Herangehensweisen an die Nutzung der Studierendendaten zur informierten Entscheidungsfindung mithilfe von Lernanalysen von drei Universitäten geprüft. Die konkreten Beispiele sind:

- Purdue University (US) mit Course Signals zur Erhöhung der Studienerfolge in Präsenzveranstaltungen. Course Signals spürt frühzeitige Warnzeichen auf und bietet Studierenden, die nicht ihre bestmögliche Leistung erbringen, schon vor Erreichen eines kritischen Punktes Hilfestellungen. Es ist einfach anzuwenden und bietet häufige, kontinuierliche Rückmeldungen in Echtzeit. Darüber hinaus bietet es schon früh Hilfestellungen – bereits ab der zweiten Studienwoche.
- Die University of Derby (UK) erforscht Strategien in Bezug auf Prozesse, die zur Verbesserung der Studienleistung führen, und stellt dabei Schlüsselfragen wie: (i) Was geht bei den Studierenden tatsächlich vor und wie können wir dies in Erfahrung bringen? (ii) Welche Berührungspunkte gibt es zwischen Studierenden und Hochschule? (iii) Welche „digitalen Fußabdrücke" hinterlassen die Studierenden in der Institution? (iv) Was ist den Studierenden wirklich wichtig?
- Die niederländische Universiteit van Amsterdam (UvA) und die Vrije Universiteit Amsterdam (VU) arbeiten mit Mitteln der SURF an der Durchführung einer Pilotstudie zu Nutzungsanforderungen für Lernanalysen. Mögliche Visualisierungsformen der Daten durch Lehrkräfte wurden für (i) die Nutzung von E-Learning-Material durch Studierende, (ii) die Reihenfolge, in der die Lernmaterialien genutzt werden und (iii) das Vorhandensein einer eventuellen Beziehung zwischen der Anzahl verwendeter Materialien und Studienergebnissen untersucht.

Der eAdvisor an der Arizona State University (ASU)

Beim e-Advisor handelt es sich um das elektronische Beratungs- und Abschlussnachverfolgungssystem der ASU. Moderne Technologie und Datenanalyse werden dazu verwendet, Studierenden bei der Entscheidung für ein Hauptfach zu helfen, das ihren Interessen entspricht, und somit sicherzustellen, dass der Abschluss erreicht wird. Das Hauptziel der Initiative ist die Erhöhung der Studierendenbindung und Abschlussrate und die Bereitstellung von hochwertiger Bildung zu erschwinglichen Kosten für eine steigende Anzahl an Studierenden.

Die Internationalisierungsstrategie der University of Nottingham (UK) und die Errichtung von Universitäten in Asien

In dieser Fallstudie werden die Internationalisierungsstrategien der University of Nottingham analysiert, die ihren Anfang im Aufbau zweier internationaler Hochschulen in Malaysia und China in den 90er Jahren nahmen. Diese Innovation wird als Teil eines tieferen und breiteren Institutsprozesses gesehen: Nottingham sollte nicht nur zu einer globalen Universität werden, sondern die Identität, Mission und Arbeitsweise der damals sehr konservativen Hochschule sollten dynamischer, vorausschauender und kreativer werden. Die Initiative wird als „befreiende Störmaßnahme" gesehen. Das allgemeine Ziel, das mit der Errichtung der zwei Hochschulen in Asien, nämlich in Semenyih,

Malaysia, im Jahr 2000 und Ningbo, China, 2004, verfolgt wurde, war die Erschaffung einer anderen Identität und Gestalt der Universität, als es alleine im Vereinigten Königreich möglich gewesen wäre, außerdem die schrittweise Einbettung einer Innovationshaltung und einer internationalen Sichtweise in der gesamten Universität.

Hauptresultate

Die Resultate der Studie sind um die vier übergeordneten Forschungsfragen herum strukturiert und spiegeln den analytischen Rahmen wider, der der Studie als Rückgrat dient. Die Hauptresultate werden im Folgenden zusammengefasst:

Die wichtigsten Herausforderungen für eine Hochschulbildung, die auf Innovation ausgerichtet ist

Es kristallisieren sich drei Hauptherausforderungen für die Hochschulbildung weltweit heraus, die gleichzeitig die Innovation dieser Branche antreiben: (i) Druck durch Globalisierung; (ii) veränderliche Angebot-Nachfrage-Situation; und (iii) Änderungen in der Finanzierung. Verschiedene Innovationspraktiken werden entwickelt und eingesetzt, um diese Herausforderungen anzugehen. Ein und dieselbe Herausforderung kann zur Einführung verschiedenster Innovationspraktiken in unterschiedlichen institutionellen Kontexten führen, während ein und dieselbe Innovationspraktik gleichzeitig in verschiedensten Herausforderungen begründet liegen kann.

Kontexte für erfolgreiche Innovationen

Erfolgreiche Innovationspraktiken benötigen ein Zusammenspiel zwischen nationalen/regionalen und institutionellen Faktoren. Die Art der Faktoren hängt von verschiedenen Einflussgrößen wie Umfang der Initiative und Autonomie einer Institution ab. Hinsichtlich des ersteren lässt sich sagen, dass der Einfluss nationaler/regionaler Faktoren um so größer ist, je weiter der Umfang gefasst wird; je mehr Begrenzungen es für den Umfang gibt, desto höher wird der Einfluss institutioneller Faktoren. Zum letzteren ist festzuhalten, dass autonomere Hochschulbildungsinstitutionen mit mehr Steuermöglichkeiten bezüglich ihrer finanziellen Mittel und der Zuteilung dieser Mittel auf ihre Funktionsbereiche tendenziell eher Bottom-up-Praktiken entwickeln. Der direkte Einfluss dieser Innovationsarten kann unmittelbarer, jedoch auch weniger breit gefasst sein, da sich häufig auf die innovationsstiftende Institution beschränkt wird. Weniger autonome Hochschulbildungsinstitutionen tendieren hingegen dazu, eher staatlich initiierte Top-down-Methoden zur Innovationsförderung anzuwenden. Dies muss die Innovationskraft nicht mindern, sondern führt im Gegenteil dazu, dass weiterreichende Beziehungen und Prozesse über das Hochschulbildungssystem hinweg unterstützt werden und größere Zeiträume für die Umsetzung veranschlagt werden, was einen langfristigeren und größeren Einfluss über Institutionsgrenzen hinaus haben kann.

Komponenten, Funktionen und Beziehungen eines Hochschulbildungsinnovationssystems

Die Entwicklung und Umsetzung von Innovationen in Hochschulbildungssystemen beeinflussen sämtliche Systembestandteile: Komponenten, Beziehungen und Funktionen. Auf Komponentenebene ist eine Vielzahl direkt und indirekt betroffener Einzelpersonen und Institute durch diese Innovationen betroffen. Bezüglich der Beziehungen entstehen die wichtigsten Auswirkungen durch Kooperation, den Aufbau von Netzwerken und eine erhöhte Mobilität, was traditionelle Beziehungen zwischen Akteuren ändern sowie neue Beziehungen

entstehen lassen kann. Bei den Funktionen wird maßgeblich die Lehrfunktion beeinflusst, mit einem weniger ausgeprägten, doch wachsenden Einfluss auf die Forschungs- und Gesellschaftsfunktion. Dies liegt wahrscheinlich daran, dass sich viele der untersuchten Innovationspraktiken noch in einer frühen Phase befinden, und ist weniger als Folge einer untergeordneten Bedeutung der Innovation zu sehen. Der Einfluss einiger Innovationspraktiken auf andere Systemfunktionen wie Forschung und gesellschaftliche Verantwortung wird sich daher höchstwahrscheinlich noch ausweiten und im Laufe der Zeit stärker hervortreten, wenn die Innovation reift und stärker in das Hochschulinnovationssystem eindringt. In einem innovativen Hochschulbildungssystem scheinen drei Entwicklungsaspekte am bedeutendsten:

- Je tiefer die Innovation in das Hochschulbildungssystem eindringt und je umfassender dessen Elemente betroffen sind, desto besser muss der Innovationsprozess verwaltet werden. Managementmethoden werden zwar in vielen Universitäten gelehrt, Universitätsmanager sind jedoch nicht hierfür ausgebildet und meist beförderte Angestellte aus der Wissenschaft.
- In einem innovativen Hochschulbildungssystem bedingen sich Änderungen oft gegenseitig: Systembestandteile (Komponenten, Beziehungen und Funktionen) beeinflussen den Erfolg der Innovation, während der Erfolg der Innovation weitere Änderungen für die Systembestandteile mit sich bringt. So ergibt sich eine Änderungsspirale, die das Hochschulbildungssystem besser auf Umweltänderungen reagieren lässt.
- Die hier untersuchten Änderungen auf Hochschulbildungsinnovationssysteme durch die Innovationspraktiken sind nicht radikaler Natur sondern vollziehen sich eher langsam und allmählich. Viele Innovationspraktiken modifizieren die traditionellen Funktionen von Hochschulbildungsinstitutionen nicht in radikaler Weise, sondern bieten eher neue Herangehensweisen an traditionelle Aufgaben, sodass besser auf veränderliche Anforderungen in der Hochschulbildung eingegangen werden kann.

Resultate und Störfaktoren
Es zeigen sich vier Hauptinnovationsresultate in der Hochschulbildung: (i) Die Vision und die Nutzung neuer Technologien begünstigen Innovationspraktiken und stellen meist keine direkten Innovationen dar; (ii) die Nutzung neuer Technologien scheint ein Wegbereiter für den Übergang von einer abteilungszentrierten Bildungsvision zu einer studierendenzentrierten zu sein; (iii) Innovation setzt häufig eine beschleunigte Entwicklung von Partnerschaften zwischen Hochschulbildungsinstitutionen und anderen Organisationen, insbesondere Unternehmen, in Gang; (iv) Innovationen in der Hochschulbildung sind ein gutes Beispiel für zwei allgemeine Hauptaspekte im Innovationsprozess: „Neues wagen" und „Bestehendes verbessern".

Störfaktoren für Innovationen finden sich sowohl auf Institutsebene, wie beispielsweise mangelnde Unterstützung der Innovationspraktiken durch die Institution, und auf Länder-/Regionalebene, z. B. durch den Einfluss der unterschiedlich ausgeprägten Autonomie von Hochschulbildungsinstitutionen. Rechtliche Rahmenbedingungen sind auch ein entscheidender Faktor, der Innovationspraktiken empfindlich behindern kann. Trotz möglicher Störfaktoren haben Innovationspraktiken das Potential, qualitativ hochwertige und vernünftige Resultate zu erzielen, sei es in Bezug auf eine bessere Zugänglichkeit von Hochschulbildung, der Fokussierung auf Studierende als zentrale Akteure im System oder auch die Schaffung möglicher Auswege aus finanziellen Engpässen, die das System belasten.

Handlungsempfehlungen

Die Handlungsempfehlungen sind in drei zentralen Themen zusammengefasst, die sich in der Studie gezeigt haben, und orientieren sich an zwei bestimmten Zielgruppen: Hochschulbildungsinstitutionen und politische Entscheidungsträger.

Handlungsempfehlungenzum veränderlichen Umfeld von Lehre und Lernen in der Hochschulbildung

Hochschulbildungsinstitutionen sollten prüfen, ob Folgendes notwendig ist:

- Förderung einer Institutionskultur, die die Kreativität erhöht, ein Bewusstsein für die Vorteile schafft, die aus der Umsetzung von Innovationen erwachsen, Offenheit gegenüber Innovationen anregt und Widerstände gegen Veränderungen abbaut;
- Einsatz von Anreizen und Belohnungen für Angestellte (einschließlich wissenschaftlich Tätiger), die innovative Praktiken einsetzen;
- Ermunterung der Fakultätsmitglieder, das Potential neuer Lerntechnologien voll auszuschöpfen;
- Aufbau einer institutionsübergreifenden Zusammenarbeit, um die Auswahl und Qualität für Studierende zu erhöhen (und dabei möglicherweise noch die Kosten zu senken);
- Einsatz geeigneter Maßnahmen zur Entwicklung der Fähigkeiten des Lehrpersonals und zur besseren Zusammenarbeit in der Lehre;
- Prüfung bestehender organisatorischer Beschränkungen und Verbindungen.

Politische Entscheidungsträger sollten prüfen, ob Folgendes notwendig ist:

- Aufbau eines eindeutigen rechtlichen Rahmenwerks zur Ansprache von Störfaktoren, denen sich manche Entwicklungen des Online-Lernens aktuell gegenübersehen, wie beispielsweise: unpassende Qualitätssicherungsmechanismen, fehlende Credit-Anerkennungsprozesse und Regelungen zu geistigem Eigentumsrecht.

Handlungsempfehlungenzu Technologie und Studienleistung in der Hochschulbildung

Hochschulbildungsinstitutionen sollten prüfen, ob Folgendes notwendig ist:

- Identifizierung der (diversen) Bedürfnisse und Umstände der Lernenden;
- Sicherstellung, dass die Lernenden Zugang zu den nötigen Technologien haben und fähig sind, diese entsprechend zu nutzen;
- Anerkennung der Abhängigkeit einer erfolgreichen Einführung von Lernanalysen von der gewählten Technologie, aber auch von der Durchführung der notwendigen Änderungen innerhalb der Institution, sodass Lehrende, IT-Angestellte und Administration in der Unterstützung der Studierenden effizient zusammenarbeiten können;
- Bereitstellung entsprechender Prozesse, Werkzeuge und Unterstützungsaktivitäten, sodass die Fakultät die reichhaltigen Daten, die durch die Analyse erzeugt wurden, in vollem Umfang nutzen kann und somit auf die

individuellen Bedürfnisse der Studierenden eingehen und die Lehre weiter verbessern kann;

- Klärung der Rollen der verschiedenen Akteure (innerhalb und außerhalb der Institution), die in die Erfüllung dieser Bedürfnisse involviert sind;
- Sicherstellung einer gemeinsamen Basis bezüglich des Verständnisses der unterschiedlichen Rollen/Verantwortlichkeiten und der Beziehungen zwischen diesen;
- Sicherstellung einer klaren Linie in Managementverantwortung und Informationsbedürfnissen, um die Leistung zu beurteilen;
- Aufbau von unterstützenden Beziehungen und Vertrauen zwischen den betroffenen Akteuren (Studierende, akademische, Support- und IT-Angestellte, Manager und gegebenenfalls Arbeitgeber).

Politische Entscheidungsträger sollten prüfen, ob Folgendes notwendig ist:
- Klärung der Finanzierungsbedingungen, beabsichtigten Resultate und Zeitpläne für die Innovation;
- Einholung und Analyse von Rückmeldungen (von Lernenden, Institutionen, Arbeitgebern etc.) zur Leistung und Wirkung und Information aller betroffenen Akteure;
- Identifizierung von unbeabsichtigten Folgen der Innovation (z. B. auf andere Funktionen, zur Ausweitung der Teilhabe oder auf den Arbeitsmarkt).

Handlungsempfehlungen zu Globalisierung und Internationalisierungsstrategien

Hochschulbildungsinstitutionen sollten prüfen, ob Folgendes notwendig ist:
- Herstellung eines ausgewogenen Verhältnisses zwischen kommerziellen, bildungs- und ansehensbezogenen Gesichtspunkten beim Formulieren der Internationalisierungsstrategie;
- Ansprache einer Reihe ineinandergreifender Faktoren wie Studierendenmobilität (ein- und abgehend), Studierendenpraktika, Qualifikationsanerkennung, Finanzierungsbedingungen, Auswirkungen auf den Studienplan und pädagogische Gesichtspunkte sowie den Arbeitsmarkt;
- Miteinbeziehung der Bedürfnisse verschiedener Akteure wie in- und ausländische Studierende, wissenschaftliche und Support-Mitarbeiter, Qualitätssicherungsagenturen, Arbeitgeber und Sponsoren;
- Motivierung von Angestellten der eigenen Universität und Aufbau von Beziehungen zwischen Angestellten der verschiedenen Hochschulen;
- Feststellung, wie viel von der eigenen Institution „exportiert" werden soll und was aufgebaut werden soll, um örtliche Kontextfaktoren an den verschiedenen Hochschulen widerzuspiegeln;
- Feststellung, wie viel von den internationalen Aktivitäten in die eigene Institution „importiert" werden soll;
- Erfüllung der verschiedenen nationalen rechtlichen und Qualitätssicherungsvorschriften.

Politische Entscheidungsträger sollten prüfen, ob Folgendes notwendig ist:

- Unterstützung von Aufenthalten der eigenen Studierenden an anderen Hochschulen und Aufnahme von Studierenden anderer Hochschulen.

1. Introduction

In meeting the objectives of the Europe2020 strategy, European institutions assigned a central role to higher education. The European Commission (EC), in subsequent communications released in 2011, 2012 and 2013, stressed the importance of education – and higher education in particular – as a key enabler of smart, sustainable and inclusive growth. The concept of innovation in higher education finds place in all the recent communications through a pledge on the side of the EC to foster, among others, the use of e-learning and blended learning, to promote interactive learning environments (European Commission 2011: 6), to make greater use of ICT and Open Educational Resources (OER) (European Commission 2012: 8, 9), to embrace more widely digital learning (European Commission 2013a: 7, 8), and to create the conditions for 'more open learning environments to deliver education of higher quality and efficacy' (European Commission 2013b: 2).

This study is firmly framed within this policy context, providing primary evidence on many of the themes that recent EC communications touch upon as far as innovation in higher education is concerned. The report aims in particular to contribute to a better understanding of recent developments in higher education and provide evidence of how innovation can support higher education in times of change.

The study builds on **four research questions**, which have guided the work since the inception phase of the project:

- What are the main challenges facing higher education and driving innovation in this sector?
- What are the key differences in terms of regional and institutional contexts for achieving successful innovation in higher education for different constituencies?
- How does innovation in higher education involve key system components and how does it influence – directly and indirectly – the system functions? What are the key processes and the roles of the key stakeholders in implementing innovation?
- What are the major outcomes of innovation in higher education and what bottlenecks and blockages exist in achieving them?

In order to gather the necessary evidence to answer these questions and to shed light on selected processes of innovation in the higher education sector, desk research and seven case studies have been conducted. The seven case study monographs are provided in annex to this report and they constitute a major output of the project. This report, in turn, brings together the evidence collected through the desk- and field- work and provides an analysis structured along three interconnected themes with system-wide significance and implications for all higher education stakeholders, as follows:

Table 1: Case studies based on themes

Case study	Theme
Innovative approaches to teaching and learning at the Olin College of Engineering (US).	The changing landscape of teaching and learning in higher education.
Macro-level blended learning at the Bavaria Virtual University (Germany).	
US- originated MOOCs (Coursera, Udacity, NovoEd).	
EU-originated MOOCs (multi- and single- institution platform providers).	
The development of Learning Analytics at Purdue University (US), University of Derby (UK), and University of Amsterdam (the Netherlands).	Technology and the student performance in higher education.
The eAdvisor at Arizona State University (US).	
The internationalisation strategy of the University of Nottingham (UK) and the establishment of campuses in Asia.	Globalisation and multi-campus universities.

Methodologically, the case studies have been selected with a view to capturing a variety of innovation practices currently developing across the globe. They were identified through a wide consultation process involving over 30 stakeholders in the higher education sector, the project steering group at the EC and the project's peer group of experts. The underlying principle of the consultation that led to the identification and selection of case studies was to establish a link between challenges (as identified and discussed in section 1.1) affecting the higher education sector and innovative practices that higher education institutions are putting in place as a response to such challenges. The case studies provide insights into processes of innovation that will have applicability to many other contexts.

The three themes have been examined against the background of several contextual factors and challenges that higher education is faced with, which are briefly described below in order to set the scene for our analysis.

1.1 Setting the scene: contextual factors and challenges

In this section, several contextual factors and challenges that affect the higher education sector and drive innovation within it are discussed, drawing on a brief literature review.

1.1.1 Contexts

The context-specific nature of innovation in higher education is illustrated by the influence of various organisational and systemic factors, as well as other factors that pertain to wider societal circumstances.

Organisational context

The 'exceptionalism' claims of universities as organisations typically refer to the importance of academic freedom and autonomy in the performance of universities' main functions and capacity for innovation. On the other hand, academic freedom and autonomy are sometimes claimed to create a lack of responsiveness to the needs of external stakeholders and

unwillingness to collaborate with actors in other forms of organisations (Amaral et al., 2003; Shattock, 1999). Other organisational factors that impact on the capacity to innovate in higher education pertain to the university governance structure and the people (students, staff) that inhabit the institutions. In the former case, university governance structures may have an inhibiting effect on innovation, as in some cases, relatively lower levels of loyalty to the institution than loyalty to the academic disciplines of academic staff have been reported. In the latter case, successful innovation often stems from individual enthusiasm and persistence. Innovations are also closely related to the specific institutional (local) context and the related institutional mission.

Systemic context

At the system level, higher education has expanded significantly and became increasingly differentiated and diversified in recent decades. The differentiation and diversification are notable at several levels, e.g. in the structure of the student body and in the nature of student learning needs, and in the nature of inter and intra-institutional structures and relationships. The extent of differentiation can be reflective of national and regional differences in economic characteristics especially, but also in student population characteristics. Another important feature is the increasing internationalisation of higher education systems. Universities increasingly play a part in a globalised world, competing for the best students, internationalised student populations and international quality benchmarks. Innovations can respond differently to systemic contextual factors and institutions can make different choices.

Wider context

Wider contextual features concern the changing nature of the societies of which higher education institutions are a part. As described by Valima and Hoffman (2007), wider societal changes have implications for higher education in terms of the nature and role of knowledge production, the changing role of the state, higher education's relationships with civic society and, above all, the role of information and communication technology. The ways of communication and knowledge exchange changed rapidly over the last decades, influencing the way universities distribute their knowledge and interact with society. The readily available knowledge on the internet has, in some instances, reduced the role of universities as guardians of knowledge and the conceived authority of scientists in societal debates.

1.1.2 Challenges

Against the background of the contextual factors just described, the broad groups of inter-connected challenges that the higher education sector is faced with have been identified: pressures from globalisation processes, changing supply of and demand for higher education, and changes in higher education funding. It is worth noting that the term 'challenge' as used in this report denotes both 'opportunities to be seized' and 'obstacles to be overcome'. Especially concerning the former, it is also recognised that these challenges are not necessarily unique to higher education, although the responses to them may well need to be. While the main focus of this report is on the education function of higher education, it is recognised that there are also challenges for the research and engagement functions, and for the inter-relations between them.

Pressures from globalisation processes

Globalisation has been identified as a crucial challenge for the higher education sector, bringing with it a weakening of national system boundaries, changing criteria of excellence and new forms of competitiveness between institutions (Ball, 2012; Brooks and Waters, 2011; Teichler, 2007). This is about much more than competition to recruit international students, and includes the importance of achieving global recognition for the relevance and standards of courses and qualifications in order to meet the labour market needs of all students (Brooks and Waters, 2011). The increasing cross-border operations of many higher education institutions, the increased mobility of both students and staff, as well as new international opportunities provided by the use of technology as a 'disruptive enabler', combine to challenge many of the well-established practices in individual institutions. Similarly, at the national level, global trends increasingly act as a reference point for national policies, especially in areas such as quality assurance, qualification structures and links to the labour market. However, as indicated later in this report, higher education institutions respond to the challenges of globalisation in different ways. These reflect both contextual differences, as well as different appraisals of the opportunities presented by globalisation.

The changing supply of and demand for higher education[1]

'Supply-side' developments pose crucial challenges for the higher education sector, arising especially from the use of new teaching and learning technologies. Online learning environments have been growing on the side of traditional learning environments and in some instances have started to replace them. The growing interest in Massive Open Online Courses (MOOCs) and forms of blended learning are prime examples of supply-side developments in teaching and learning. Furthermore, technologies may also have an impact outside the classroom, as exemplified by the use of Learning Analytics (and similar initiatives) that may affect the traditional conception of the overall student experience in higher education, and indeed influence the students' performance. These developments have implications for pedagogic practices in all higher education institutions, and for those who learn or teach (or support learning in other ways) in them.

The demand side is undergoing substantial changes as well. These include the changing students' financial circumstances, the need of many to combine paid work or domestic duties with their higher education, anxieties about employment opportunities, for some a desire to travel and for others a desire to remain at home, changing preferences for subjects of study, study methods, the extent of engagement with the non-academic features of university life (Orr, 2012) and changing lifestyles, influenced for instance by widespread use of social media (Fuller et al., 2011). New expectations on the side of students are accompanied by changing needs of employers (as labour market stakeholders of universities and future employers of the students) regarding the numbers and kinds of graduates (Brown et al., 2004; Schomburg and Teichler, 2006). Employers' expectations are inevitably interlinked with broader societal/economic changes regarding workforce development with growing demands for lifelong and work-based learning (lifelong learning as facilitator of mid-career changes).

In responding to the growing diversity of external demands, an increasing differentiation of higher education institutions is occurring, bringing with it questions and challenges for individual institutions as to what kind of higher education institution they want to become. This

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[1] The terms 'supply' and 'demand' are not used here solely in their economic meanings. 'Supply' potentially encompasses all internal features of higher education institutions, while 'demand' refers to the external environment in which they operate,

includes consideration of the balance of emphasis given to education, research and engagement functions, and to the relationships between them.

Changes in higher education funding

The expansion of higher education in recent decades is one of the causes that have inevitably led to increasing costs and to growing debates about who should meet those costs, e.g. the balance between the state and the consumer/student when it concerns the education function, and the balance between the state and businesses/users when it concerns the research and engagement functions. More broadly, financial pressures on the higher education sector derived from increasing demand bring to the fore questions on cost-sharing and the balance between individuals' contribution to the cost of higher education and the contribution of society at large, notably through public funding (Barr, 2004; Woodhall, 2007). This inevitably entails consideration of both the 'individual' and the 'societal' benefits of higher education and of the relationships between them (Brennan et al., 2013). There is currently considerable differentiation between national systems in funding arrangements, and changes in funding typically affect some institutions and subject areas more than others. The challenges of funding are creating considerable uncertainty within many countries and institutions.

In responding to a changing funding situation, higher education must either find ways of cutting costs or of generating additional revenue, or both. This implies looking at how current activities are being performed and finding new (and cheaper) ways of doing them, as well as undertaking new activities, possibly for new markets. But for doing anything new, financial viability concerns are raised. Thus, pressures to innovate increase, but concerns about the costs of innovation also grow. Private providers of higher education also play a role in funding. Examples of private providers providing low cost alternatives to public higher education can be found in some countries, while in others they represent an elite high cost and highly selective sector (Jongbloed, 2010; Strehi et al., 2006).

1.2 Structure of the report

The report follows the structure presented below:

- **Chapter 2** introduces the concept of 'innovation systems' and the perspective of a higher education innovation system as a sub-set of an innovation system, concentrated particularly in higher education institutions (universities and associated research institutes, vocational training institutions, master's colleges, etc.), which are seen in close connection with other institutional spheres, such as industry, government and non-government agencies, and the society at large. The higher education innovation system has been used as the analytical framework guiding the primary research undertaken within this project, i.e. the seven case studies. The three main elements of the higher education innovation system, namely functions, components and relationships are discussed in detail;
- **Chapters 3 to 5** discuss the three main themes identified in the project, connecting evidence from the literature with that from the seven case studies;
- **Chapter 6** provides the conclusions, clustered around the four overarching research questions, and a set of recommendations, grouped according to the three themes that emerged from the case studies, and targeting higher education institutions and policy-makers.

2. Analytical Framework

This chapter describes the building blocks deployed to frame the primary research conducted within this project through the seven case studies.

2.1 Introduction: defining innovation

We start from a broad definition of innovation, which is an adaption of the OECD definition contained in the Oslo Manual to the higher education sector. In this study, innovation is defined as:

> A new or significantly improved **product**, **process**, **organisational method** or an **organization** itself developed by or having a significant impact on the activities of a higher education institution and/or other higher education stakeholders.

In view of improved understanding of the nature and dynamics of innovation in the higher education sector, we introduce the concept of a 'higher education innovation system' as an analytical construct that synthesises the key features of the higher education sector into an 'innovation system' format defined according to systems theory as a set of components, relationships and functions (Carlsson and Stankiewicz, 1991; Carlsson, 1998, 2003; Carlsson et al., 2002; Hekkert et al., 2008). This conceptual framework offers a broad perspective for understanding the sources, dynamics and development paths of innovation in higher education and delineates how new regimes appear through creative reconstruction. We start with a brief introduction of the 'innovation systems' concept and on that basis, make the transition to higher education innovation systems as a sub-set of innovation systems.

2.2 The 'innovation systems' concept

The 'innovation systems' concept was introduced in the late 1980s to examine the influence of knowledge and innovation on economic growth in evolutionary systems where institutions and learning processes are of central importance (Freeman, 1987; Freeman and Lundvall 1988). The systems perspective was used to better understand how institutional arrangements can facilitate interactions among economic actors in market- as well as non-market knowledge transfer (Carlsson, 2003). The concept was refined as 'national innovation systems' (NIS) which includes a set of innovation actors (firms, universities, research institutes, financial institutions, government regulatory bodies, etc.), their activities and their inter-linkages at the aggregate level (Freeman, 1987; Dosi et al., 1988; Lundvall, 1988; 1992; Nelson, 1993; Edquist, 1997, 2005). The 'national' dimension of innovation systems[2] favoured user-producer interactions through cultural and institutional proximity and localised learning (Lundvall, 1992), but became increasingly blurred due to business and technology internationalisation extending technological capabilities beyond national borders, and the growing integration of innovation systems, driven by the economic and political processes, e.g. the European Union consolidation.

As the NIS approach did not fully capture the interactions between innovation actors, more disaggregated levels of the innovation system were introduced, such as:

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[2] In the sense of specific national factors, like history and culture, institutions, laws and policies that shaped technological capabilities of a country.

- Regional Innovation Systems (e.g. Cooke, 1996; Malmberg and Maskell, 1997) emerged in the context of the increasing regionalisation of the early 1990s at technological, economic, political or cultural levels in many countries. The concept comprised for example, a set of regional actors aiming to reinforce regional innovation capability and competitiveness through technological learning (Doloreux and Parto, 2005), regional 'technology coalitions' arising from geographical distribution of economic and technological effects over time (Storper, 1995), or dynamic, self-organizing business environments (Johansson et al. 2005), etc.;
- Sectoral Innovation Systems (Breschi and Malerba, 1997; Malerba, 2002) examine industry structure as a determinant of firm's performance heterogeneity and explore coordination forms in supply chains (hierarchy, market and hybrid forms);
- Technological Innovation Systems (Carlsson and Stankiewicz, 1991; Carlsson, 1997; Bergek et al., 2007) focus on the network of agents that interact in function of a specific technology or set of technologies.

All these system frameworks are generally characterised by three elements (Carlsson and Stankiewicz, 1991; Carlsson, 1998, 2003; Carlsson et al., 2002; Hekkert et al., 2008):

- **Components (and boundaries)** of the system include various actors that normally interact in the process of innovation (individuals and firms, higher education and research institutions, government agencies, trade associations and other units making up the institutional infrastructure). The boundaries between components can be more easily identifiable, e.g. when they are defined by geography or administrative units as in the case of spatially bounded systems (regional, NIS), or more difficult, as in the case of spatially open systems (e.g. technology innovation systems bounded by 'technology' or sectoral innovation systems, bounded by 'sector');
- **Relationships** among system components, which include new knowledge combinations generated by the innovation actors, either through their own efforts or by using technology transfer from other actors, provided they have sufficient absorptive capacity. Internal R&D capacity of the actors is essential in this process, but non-R&D (non-market) interactions are also important;
- **Functions** of the system, in the sense of competencies of the components that determine the system's performance. The main function of an innovation system is defined as the generation, diffusion and utilization of technology, while the competencies necessary to achieve this function are described as four types of capabilities: (i) selective (strategic) capability, (ii) organizational (integrative or coordinating) ability, (iii) technical or functional ability; and (iv) learning (adaptive) ability.

This definition of innovation systems takes into account not only the system's structure, but also the processes (dynamics and achievements) in which the system is involved, as a complement to the system structure, in order to capture the dynamic evolution of the system in a so-called 'structure/process approach' of innovation systems (Bergek et al., 2007).

2.3. From innovation systems to higher education innovation systems
Building on the structure/process characterisation of innovation systems discussed above, we define a higher education innovation system as a sub-set of an innovation system, concentrated particularly in higher education institutions (universities and associated research

institutes, vocational training institutions, master's colleges, etc.[3]), which are in close connection with other institutional spheres, such as industry, government and non-government agencies, and the society at large. The concept of 'higher education system' can be applied at a national level, but it can also have a local, regional or global focus, as higher education activities occurring at these levels cut across national boundaries (Castells, 1996).

A higher education innovation system can also be seen as a set of **functions**, **components** and **relationships**, which allow us to disaggregate the various levels of interactions among the elements of the system and analyse the unfolding of innovation in higher education, as summarised in Table 2.

Table 2: Structure of a higher education innovation system

Higher education innovation system		
Functions	**Components**	**Relationships**
• Education; • Research ; • Engagement ('third mission').	• Direct and indirect actors; • Institutional and individual actors.	• Collaboration / conflict moderation; • Substitution; • Networking.

2.3.1. Functions of the system

Higher education is a crucial sector for the **production**, **dissemination** and **transfer of economically productive knowledge**, **innovation and technology** in today's knowledge economy (Naidoo, 2010).

If innovation systems theory defines the main function of an innovation system as the generation, diffusion and utilization of technology (e.g. Carlsson et al 2002: 235), we identify the **central functions** of higher education as providing education, undertaking research, and a 'third' mission of service to society, community engagement and entrepreneurialism, which covers the entire spectrum of activities directed to knowledge transmission, knowledge creation and knowledge transfer[4] (Table 3).

In our approach, the emphasis is placed on the first function: education. This function is closely related with the other two functions. We look at the functions of higher education systems in a dynamic way, considering how innovation within one function can have an impact on the other functions as well.

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[3] See e.g. the Carnegie Classification of Institutions of Higher education in the US, which defines All-Inclusive Classifications (e.g. Undergraduate Instructional Program, Graduate Instructional Program, Enrolment Profile, Undergraduate Profile, Basic classification) and Elective Classifications (e.g. Community Engagement). http://classifications.carnegiefoundation.org/

[4] We also note that there is a substantial academic literature which refers to functions in rather different terms. For example, Martin Trow's distinctions of 'elite', 'mass' and 'universal' functions are defined respectively as 'shaping the mind and character of a ruling class and the preparation for elite roles', 'the transmission of skills, preparation for a broader range of technical and economic elite roles' and the 'adaptation of a 'whole population' to rapid social and technological change' (Trow 2006, 556). Manuel Castells has written about 'contradictory functions' of universities in responding to 'multiple pressures', citing as an example the functions of 'selection and socialisation of a dominant elite' and 'training of a skilled labour force' (Castells, 2001). More broadly, contradictory functions of education systems have been described by Moore in terms of 'liberal' and 'elite reproduction' theorists (Moore, 2004).

Table 3: Overview of functions of higher education systems

Functions of higher education systems		
Education	**Research**	**Third mission**
- Teaching and learning; - Curriculum development; - Student assessment; - Student mobility ; - Accreditation.	- New knowledge creation ; - Testing and measurements; - Experimentation; - Validation of results; - Dissemination of results, etc.	- Protection of Intellectual property; - Creation of spin-offs; - Contracts with industry; - Contracts with public bodies ; - Participation in policy-making; - Involvement in social and cultural life; - Public understanding of science[5] .

2.3.2. Components of the system

The components of a higher education innovation system primarily include the individual and institutional actors who contribute to generating, diffusing and using innovation in the system. They can act both within and outside the higher education sector, but have a direct interest in the higher education sector. These can be considered as direct actors.

Direct individual actors include:

- Students, which can variously be defined as 'junior members', 'consumers' and, of course, 'learners';
- academic staff (faculty, teaching and research assistants, coaches and mentors, etc.), differentiated in terms of seniority and authority levels, with significant differences in the power of the university professors between different national systems (Kehm and Teichler, 2012);
- Other staff (e.g. academic administrators and an increasing numbers of new 'professionals' who bridge the traditional divide between academic and administrative roles (Whitchurch, 2010,) such as technology transfer managers, IP experts, patent attorneys, etc.

Direct institutional actors include: universities with their departments, schools and labs, associated research institutes (often interdisciplinary), technology transfer offices and industrial liaison offices, business support institutions (science parks, business and technology incubators, start-up accelerators), financial support institutions (public and private venture capital firms, angel networks, seed capital funds, etc.)

In addition, a higher education innovation system may be also be shaped by indirect actors, such as individuals, organisations, or institutions from the social, economic, and political

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[5] Schoenet al 2006, as cited in Laredo 2007

spheres at national, regional and local governments, 'users' of the knowledge created or of the trained manpower produced, such as businesses and employers' organisations, as well as society at large, and networks of academics, alumni and others, who possess the power to bestow status and reputation. They do not play an active role in the higher education sector, but are still indirectly affected and need therefore to be taken into account.

Higher education innovation systems acknowledge the importance of individual innovators (scientists, students, entrepreneurs, etc.) and their role in initiating and consolidating institutional processes in higher education. Innovation actors in higher education may have different roles in different situations and a single actor may play several roles. A categorisation of roles includes:

- Clients / beneficiaries;
- Drivers / initiators;
- Executive agents;
- Decision-makers;
- Brokers / facilitators;
- Veto-players.

Finally, additional components of a higher education innovation system may be found in the regulatory and legislative activity of governments which shape the innovation system. As an example, the Californian government recently introduced legislation that requires public colleges and universities to grant credits to students who take courses online in the event that they are not able to sign up to regular classes because these are oversubscribed (New York Times, 2013). In a similar fashion, Dutch higher education institutions were prompted to develop tools such as Learning Analytics as a consequence of, among others, the 'government's pressure to report their success rates and performance' (Open Educational Resources Special Interest Group 2013: 98) and because of their performance agreements signed with the Ministry of Education, Culture and Science (ibid.).

2.3.3 Relationships among system components

The relationships among system components primarily focus on how innovation affects the way actors of higher education systems interact and perceive each other. The nature of the relationships between components of the system can be financial (e.g. how much does a given initiative cost for an institution? What is the expected return? As well as non-financial (e.g. does an institution gain in status and prestige? Do particular academics and/or departments emerge as winners and others as losers?). Three broad types of relationships are identified:

First, **collaboration and collaborative leadership** (led for instance by an Innovation Organizer) entails several processes (bottom-up and top-down) carried out in a collaborative fashion by different stakeholders (individual and institutional actors) drawn from different spheres. 'Mode 2 of science production' places collaboration with external organisations at the centre of the knowledge production function of universities (Gibbons et al., 1994; Nowotny et al., 2001), while the 'triple helix' of university, business and the state (Etzkowitz and Leydesdorff, 2000) brings the university as a key player in innovation to the fore, on par with

industry and government. Innovation often requires new forms of collaboration which may sometimes be blocked by the competitiveness inherent to market-led forces (Hazelkorn, 2011), therefore a good balance between collaboration and competitiveness is essential for good relationships between institutions and the individuals.

Collaborative leadership can be very effective in **conflict moderation** between innovation actors, who may sometimes have a conflicting relationship, for instance if innovation triggers a divide between junior and senior staff, or ivory-tower and entrepreneurial academics, etc. Organizational innovation and cross-functional collaboration literature identifies two key types of conflict: (i) task conflict, which is content-driven and is generated by differences of opinions of an organization's functional departments about particular tasks (Amason and Sapienza, 1997); and (ii) relationship conflict, which is person-driven and is generated by incompatibilities or clashes between different personalities in different departments, leading to negative feelings such as tension and frustration (Jehn and Mannix, 2001; Finkelstein and Mooney, 2003). Task conflict has been shown to play a positive role in innovation by leading to a reconsideration of dominant perspectives and beliefs in an organization and stimulate original and divergent viewpoints (Van Dyne and Saavedra, 1996), while relationship conflict has a negative effect on the high-quality knowledge exchanges and decision-making (Amason, 1996; Jehn, 1995; Jehn and Mannix, 2001; Pelled et al., 1999).

Secondly, **substitution** arises when one institutional actor takes the lead on a function traditionally belonging to a different actor. For instance this occurs when higher education institutions, in addition to their teaching and research activities, engage in technology transfer and firm formation, providing support and even funding to encourage entrepreneurial ventures, thus enacting some of the traditional role of industry. Industry can also display substitution by taking the role of the university in developing proprietary education and training solutions, often at the same high level as universities (see for example, Pixar University, Intel Educator Academy, Cisco Networking Academy or Apple University). Government agencies can also display substitution when they take up, in addition to their traditional function of regulation and control, that of investment and provision of public venture capital - a traditional task for the industry sphere (e.g. Huggins, 2008; Gebhardt, 2012).

Thirdly, **networking,** as a manifestation specific to the increasingly collective nature of science, technology and innovation, is also relevant in higher education systems. The aggregation may be stronger or weaker, depending on the network's age, scope, membership, activities and visibility in the public domain (e.g. the Association of University Technology Managers (AUTM), the European Technology Platforms and the Joint Technology Initiatives, to mention just a few examples[6]). Research networks in academia have become comparable to a 'joint venture', whose stability appears to be of critical importance socially, politically and economically, in order to generate a particular division of labour among the participants (David, et al. 1999). Recent research suggests that the academic profession today exerts

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[6] The European Technology Platforms (ETPs) are industry-led multinational networks (36 ETPs in 2011) of various stakeholders who define a common vision and implement a medium- to long-term Strategic Research Agenda in key industrial areas for Europe's competitiveness and economic growth (http://cordis.europa.eu/technology-platforms/). The ETPs have provided major input to European research programmes such as FP7, and some have been involved in the establishment of the Joint Technology Initiatives (JTIs), a form of long-term public-private partnerships that combine private sector investment and/or national and European public funding (five JTIs in 2011) (http://cordis.europa.eu/fp7/jtis/).

much of its power through cross-institutional networks and national and international organisations, which set the frameworks in which individual institutions must operate (Bleiklie et al., 2011). Academics in particular often value memberships and relationships within cross-institutional networks more than those within their employing organisation. Also, more senior academic staff often exerts more power and authority through external (national and international) organisations and networks than through their employing organisation (Bleiklie et al., 2011). Students' network relationships are often shaped by age and social class, as well as by the 'distance from home', i.e. living at home or having 'gone away' to study. For the former, pre-university relationships and networks are maintained, while for the latter, new relationships and networks are formed and social capital acquired, as past identities and relationships may fade away. Networking reflects the growing non-linearity and interactivity of innovation processes (Kaufmann and Tödtling, 2001) and provides several benefits[7] (Steinmueller, 1994). These relationships are important as they reflect change-inducing, evolutionary social and economic mechanisms at work in higher education interactions.

Overall, using an innovation system approach serves two main purposes:

- Moving beyond higher education as a broad category and looking into single elements that compose it (components, relationships and functions). This will allow us to pinpoint exactly why, how, and what innovation takes place and who are the actors that drive (or hinder) innovation;
- Taking a dynamic approach, by looking not only at innovation within the elements described above, but also at the interaction within and among components, relationships, and functions.

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[7] For example, increasing network value with higher number of participants, reduction of research projects overlapping through network centralisation, complementary investments for information dissemination that may lead to economic benefits and easier access to information flows within the network by governments and firms, increasing their choices about specialisation, co-operation and competition (Steinmueller, 1994).

3. The changing landscape of teaching and learning in higher education

The three thematic chapters (chapters 3 to 5) are organised according to the same structure. Each chapter comprises: an introductory review of relevant thematic literature, highlights drawn from the case studies related to each of the themes, and a list of findings that emerge from the literature and the case studies and that are deemed relevant for (mostly) higher education institutions and policy-makers in achieving successful innovations in each of the thematic areas that have been identified.

3.1 Overview

Teaching and learning in higher education have experienced various innovative practices, with varying degrees of reliance on technological advancements, in order to, among other aims, increase student engagement rates, improve learning outcomes, diversify choice of subjects and increase flexibility in terms of delivery (time/place). Novel approaches include: (i) a movement to online learning technologies, (ii) blended learning (i.e. the combination of 'traditional learning' and online learning), both at course level and programme level, and (iii) innovative practices in teaching and learning not reliant on technology, such as student-centred and project-based learning.

Online education

The delivery of online education can take the form of an adjunct model (the use of ICT to enhance traditional face-to-face or distance learning), a mixed model (a significant portion of the course is offered online) and a completely online mode (ICT is the primary teaching medium). Online learning has developed further thanks to significant technological advancements and the increasing demand of students, with distance education providing more access to learning (Taylor and Newton, 2013). Many institutions are now exploring online learning technologies, which range from electronic books and learning materials, podcasting, blended learning to full online delivery of courses. In online education, the rapid growth of MOOCs is particularly relevant. While still relatively limited, the literature on MOOCs offers some insights as to how they are developing and their possible impact on the higher education sector. It is also important to emphasise that MOOCs as an innovative phenomena are evolving rapidly. In the brief time since collection of the case study data was completed one of the European MOOCs, Futurelearn has now released its first public courses. At the same time one of the United States' case study MOOCs, Udacity has signalled an important change of direction with the introduction of fee charging courses that provide tutor support[8], a development that appears to make this kind of MOOC closer to the online provision offered by many conventional universities.

Two strands of MOOCs have been identified, the so-called constructivist cMOOCs and the more traditional xMOOCs (Siemens, 2012). The cMOOCs model emphasizes 'creation, creativity, autonomy, and social networked learning', while the xMOOCs model emphasizes 'a more traditional learning approach through video presentations and short quizzes and testing'

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[8] https://www.udacity.com/success. It is interesting to note that the Udacity website now distinguishes between courseware and courses "The difference between enrolling in a course versus viewing free courseware is like the difference between attending a great class versus simply reading a textbook".

(Siemens, 2012). It is the latter, xMOOCs that have gained considerable public attention. However, it would be a mistake to assume that all xMOOCs adopt the same approach; clear differences between the main providers can be identified (Armstrong, 2012). While MOOCs have stimulated considerable interest and debate and potentially may make a very significant impact, it is too early to say whether they should be considered 'game changers' for higher education (UUK, 2013). Some writing appears to suggest that MOOCs are a completely new phenomenon; however we would argue that MOOCs need to be understood within the context of both the growth of Open and Distance Education[9] and developments around OER and Open Courseware[10]. All these initiatives have rather long histories and suggest that the MOOCs also have a component of 'building on and improving existing things'. In focussing on MOOCs in this study we are not seeking to diminish the significant and increasing role of Open and Distance Education and Blended learning or to suggest that MOOCs offer a template for future development (it is far too early to make any such assessment) but we do believe the challenges offered by MOOCs to current educational systems deserves close attention.

A final introductory note on MOOCs has to do with the research agenda that couples the teaching and learning function carried out by MOOCs. For edX, an xMOOC, it is a key objective to '[…] go beyond offering courses and content. We are committed to do research that will allow us to understand how students learn, how technology can transform learning, and the ways teachers teach on campus and beyond' (edX, 2013). Similar views are also expressed at Stanford, 'Our first and foremost goal in exploring the potential of these technologies is to improve the education we offer to our own students.' (Etchemendy, quoted in Johnston, 2013). An evaluation report from Edinburgh University identified as a spinoff from their MOOC involvement 'a lively internal debate about pedagogy, online learning and costs/benefits of university education' (Edinburgh, 2013).

Blended learning

Blended learning is the effective integration of traditional face-to-face instruction and online learning approaches, which can be implemented as a transformative solution to problems with student learning and to organizational and institutional needs within higher education (De George-Walker and Keeffe, 2010). In other words, blended learning is the 'fundamental reconceptualization and reorganization of the teaching and learning dynamic' (Garrison and Kanuka 2004:97), not simply the addition of an approach to the existing structure (face-to-face or fully Internet-based learning). The effective integration of the two can lead to a significant shift of the nature and quality of education.

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[9] Distance Education has a long history. The University of London International Programme for example, celebrated 150 years of existence in the same year that the term MOOC was coined (Kenyon-Jones and Letters, 2008). The growth and expansion of the so-called "mega-universities" as a world-wide phenomenon has been well documented (Daniel, 1998). There has been considerable analysis of many aspects of these institutions including the costs and economics of distance learning (Rumble, 2001), the use of Technologies (Bates, 1995; Mason and Kaye, 1989) and pedagogy and student support (Simpson and Simpson, 2002).

[10] A second influence is that of Open Educational Resources (OERs), Learning Objects and more generally Open Access Publishing. Related developments such as iTunesU have been significant. The MIT Open Courseware Project (MIT, 2002) aims to make available educational materials from its courses openly available to anyone anywhere. This approach has also been taken up extensively elsewhere. The Open Education database lists courseware projects from around the world (OEDB, 2013) and the importance of Open Education and Open Educational resources has been widely recognised (Cape Town, 2007). The Open Courseware project influenced later MOOC developments from MIT, as did the Stanford online projects impact on Coursera.

Blended learning is often implemented as a response to increasing class size and student dissatisfaction with their learning experiences (Garrison and Vaughan 2013). Student engagement with and perception of blended learning has been widely discussed; there is a significant correlation between positive perception and higher grades. High achievers were more satisfied with blended learning courses and found them more engaging and convenient (Owsten, et al., 2013). Owsten, et al., (2013) believe this may be because lower achieving students may not be able to cope with the blended learning environment as well as their peers. Blended learning may create an advantage over face-to-face education (Garrison and Vaughan 2013:24). Blended learning has a salient impact on the development of skills for its participants, including 'flexibility, reflection, interpersonal and teamwork skill development, motivation […]' (Garrison and Kanuka 2004: 98), as well as a recorded increase in efficiency and convenience for students and faculty. Blended learning can also encourage transformative institutional change.

A closely related concept is macro-level blended learning, combining the traditional face-to-face learning with online learning possibilities at programme level: one course is provided completely online, the other face-to-face. Macro-level blended learning minimises the dangers of social isolation sometimes associated with e-learning (Rühl, 2010). Successful blended learning programmes have been developed by individual universities or consortia and these offer well regarded degrees and qualifications, such as the EuroMBA-Programme[11].

As the technological means are readily available, Garrison and Vaughan (2013) find that sustained collaborative leadership is crucial for successful implementation of blended learning. The development of blended learning entails several steps: the creation of a formal approach to policy and operations which support blended learning, strategic and operational planning, the correct assessment of resources, scheduling of courses, and the provision of support to faculty and student participants (Garrison and Kanuka 2004).

Innovative practices in teaching and learning not reliant on online technology

Many innovations in traditional forms of learning are not dependent on the employment of technology. Examples of such approaches include Student-centred learning (SCL) and Problem-based learning (PBL). SCL focuses on the needs of the student, rather than those of other actors in the education process, like teachers. This may include allowing students to determine learning strategies and learning speed (Di Napoli, 2004), with direct implications for the flexibility of the curriculum, course content and interactivity in the educational process (Attard et al., 2010). Examples of this include team learning, problem-based learning, and student self- regulated learning (Attard et al., 2010). PBL is a variety of enquiry-based learning that uses real-world problems and centres on learning through solving these complex problems to promote knowledge, acquisition and collaborative learning. There is no one form or model of PBL that promotes a single and specific type of teaching; PBL was developed at McMaster Medical School in the 1960s as a way to help students master critical problem solving. The approach was soon adopted by other institutions, who interpreted it to fit with their subjects and curricula, creating forms of PBL like hybrid PBL, traditional course and course-by-course models (Major and Palmer 2001). PBL improves student engagement and

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[11] Further information on the EuroMBA can be obtained at: http://www2.euromba.org/

helps develop generic skills, though no significant effect on grades has been recorded (Major and Palmer, 2001; Allen et al, 2006).

3.1.1. The challenges driving innovation in teaching and learning

The increasing development and use of online education has been consistently driven by a mix of the various challenges outlined at the beginning of this report, namely the changing supply of and demand for higher education, the pressures from globalization, and changes in funding. Innovative practices that rely less on technology on a larger scale, such as blended learning and problem-based learning, are driven primarily by changes in supply of and demand for higher education. These challenges are discussed below with specific reference to innovative teaching and learning.

Challenges in online education

Large scale online education has become an important element in the higher education sector. The development of online education and of MOOCs, in particular, is driven by the possibilities of opening up higher education on a global scale (Koller, 2012). The significant numbers of students attracted to MOOCs to date certainly reinforce this aspiration. The geographical distribution of these early adopters also provides evidence of their global reach: as of today, Coursera alone has 5,625,302[12] registered students[13] from over 200 different countries, although it is open to question as to the extent they have so far succeeded in 'opening up' higher education. MOOCs have also been driven by the competitive pressures exerted by the globalisation processes. A recent Institute for Public Policy Research (IPPR) report (Barber et al., 2013) sees MOOCs as a key element in the unbundling of higher education, whereby 'the models of higher education that marched triumphantly across the globe in the second half of the 20th century are broken' (Barber et al., 2013) and globalisation and the impact of technology will threaten many aspects of conventional universities, enabling the unbundling of key components that can then be 're-bundled' subject to market competition and offered by a variety of different providers. It is not only the globalisation processes; however, that drives the rise of MOOCs. In order to understand the MOOCs, it is also crucial to keep in the framework of analysis the changing demand for higher education, notably the changing characteristics and objectives of learners. For instance, MOOCs may be more relevant to lifelong learning agendas than to initial post-school higher education. Also, learners may not always be motivated by the need for academic credentials (e.g. over 30% of students who studied at the UK Open University already held degree qualifications and were often not interested in adding more to them hence, the low completion rates.)

Challenges in blended learning

Blended learning is often employed in response to rapid growth, the desire to give access to more students, lack of physical infrastructure, or the desire for increased flexibility for faculty and students (Graham et al, 2013). Blended learning is also faced with several institutional challenges, including policy, resource, action plans, and faculty support (Garrison and

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[12] The number of enrolled students changes on a daily basis. The figure is from the Coursera website (https://www.coursera.org/), last accessed on 2nd of December 2013, at 11.33am

[13] However, questions have been raised about retention and dropout. Jordan's analysis suggests that most MOOCs have a completion rate of less than 10%, while Feldstein gives an overall figure of 7.6%, calculating from her data (Jordan, 2013; Feldstein, 2013). Nevertheless, it has been suggested that traditional measures of retention for MOOCs may not be appropriate, as generally there are no academic consequences to non-completion (Feldstein, 2013).

Vaughan, 2013), all issues deriving from the implementation and development of blended learning. Garrison and Vaughan (2013) argue that with strong leadership and awareness-raising activities, many of the institutional challenges can be mitigated. Similarly, those engaging with blended learning (i.e. faculty members), should be advised and trained to ensure that technology does not become a barrier or challenge. The increased role of online learning increases the danger of students' disengagement with the course and the institution in general (the learning analytics case study highlights this issue to a large extent as well, see the University of Derby as an example). However, in mass and diverse higher education systems, levels and kinds of student engagement differ significantly, reflecting differences in external commitments (work and domestic) and in life stage and aspirations. Even within very traditional classroom-based education, there is often variation in the numbers of students who attend lectures.

Challenges for innovations in traditional forms of education

Drivers for innovation in traditional forms of education include institutional efforts being developed at European level (e.g. the renewed commitment for teaching styles like SCL and PBL as reiterated in the Bologna Process from 2009) and at a national level (e.g. in many countries, SCL has been repositioned as a significant way to widen participation in higher education). Beyond these institutionalized reaffirmations of new ways of learning, the recognition of the diversity among students and their optimal learning environment is driving salient changes in teaching and education; these adaptions of teaching and learning are customer-focused (Attard et al., 2010). Challenges for novel practices in traditional education, include optimizing its efficiency and effectiveness – PBL courses cover about 80% of the same curriculum compared to a conventional course in the same amount of time – and assessment procedures, as traditional methods (e.g. examinations) may not be appropriate for newer course structures (Major and Palmer 2001). Implementing PBL approaches can also be costly, both financially and in relation to time spent on preparation, teaching and assessment.

Opportunities and obstacles for institutions in responding to these challenges

While there are opportunities presented by these challenges for improving the quality of higher education and for extending access to it, there are also obstacles to be overcome deriving from the traditional internal structures of institutions of higher education. The relative autonomy of the institutional 'basic units' (Becher and Kogan, 1993) of departments and faculties within many higher education systems can limit the capacity for inter-disciplinary work and for the cross-institutional collaborations which this can require. The emphasis placed on the research function in many higher education institutions can limit the capacity for the initiation of successful innovations which concern education. There may be a lack of incentives to address challenges in addressing the latter compared with the career and institutional rewards to be gained from success in the former.

There are also dangers that the deployment of new learning technologies may encourage more passive learning among students. Thus, institutions face the challenge of providing active learning opportunities for their students and this may require changes in pedagogic methods. These are likely to include more collaborative learning – peer learning, social learning, personal inquiry learning – as well as opportunities for unstructured learning – brainstorming, meetings, conversations, and social media. Making knowledge and information available to students is

just one aspect of the pedagogic process. Technology is an increasingly important part of the process but learning is its principal focus and outcome.

3.1.2 Actors, roles, institutional processes

Major actors in teaching and learning are the institutions providing higher education, faculty and staff and students. Institutional actors are more prominent in the implementation of online learning tools, as a notable change often occurs in strategy and collaboration at an institutional level; while teaching and learning will also be part of an institutional strategy and decision-making process, students and teachers are more salient actors in their implementation, interacting directly with, often even creating and designing, the learning process.

In many countries, the development of distance learning opportunities in the 1970s and the subsequent development of online learning possibilities by Open Universities were state-driven initiatives. More recent developments have, however, changed this landscape, and significant examples of online learning provisions can be found within **universities**, as for instance in the MOOC providers spun off from Stanford, who are embedded in the local entrepreneurial ecosystem and backed by private venture capital. In this respect, venture capital stands out as a notable feature of the business model adopted by some of key MOOC innovators, which may be a reason why MOOCs providers have been able to innovate and expand so quickly. There has also been a strong involvement from educational publishers and learning technology companies (Pearson, Blackboard). This can be seen as part of the 'unbundling' process outlined above (Barber, 2013).

On the other hand, **governments** can also be found as significant stakeholders in the development of such initiatives, as for example in the case of FutureLearn, where the UK government has signalled the strategic importance of MOOCs (Willets quoted in Olds, 2013) and the UK Prime Minister took representatives of FutureLearn on a trade mission to India (Inside Higher Ed, 2013b).

Faculty members are key actors in the development and implementation of new ways of teaching and learning. Faculty members have the opportunity to implement new ways of learning in the classroom, such as blended learning, problem-based learning, or other innovative methods; they act to facilitate the learning process, rather than solely providing knowledge (Hmelo-Silver, 2004). Bohle Carbonell et al (2013) argue that the full potential of faculty members should be used in implementing blended learning, starting from using their creative power to design and deliver courses using a bottom-up change process. This focus will allow programmes to better match the needs of the learner and teacher, build incentives in solving institutional bottlenecks and increase the creation of new knowledge in higher education institutions (Bohle Carbonell et al., 2013). The extent to which innovative possibilities are used in full depends often on the individual faculty members' willingness to do so, as well as the responsiveness of the students to the new opportunities provided.

Innovative processes in teaching and learning are designed with **students** in mind, and in some cases, students can feed into the design of their learning experience. In relation to the latter point, Fraser and Bosanquet (2006) consider curricula to be dynamic processes in which the teacher and student can act as 'co-constructors of knowledge' (Fraser and Bosanquet 2006). The true degree in which students should or can participate is in part dependent on

how staff engages with curricular development, staff experience and expertise or student availability to do so, coupled with the need to prepare and offer guidance to students (Bovill et al., 2009). Bovill et al. (2009) also recognize the limited research on student participation in curriculum design. MOOCs are also seeing an increased involvement of students: the cMOOC approach, where there is a dominant interest in 'building collective capabilities of the whole network', encompasses concepts of reward and personal status, providing students with the opportunity to develop their peer assessment skills (O'Toole, 2013: 5). Peer assessment can take many forms, including grading by peers, designating students as 'expert assessors', micro-feedback etc. Peer assessment practices have also extended to the evaluation of students' abilities outside of the classroom; MOOCs with a particularly diverse student group are well placed to offer this kind of assessment and feedback (O'Toole, 2013).

It has also to be recognised that a new generation of students is entering higher education and is bringing with it a new set of skills and expectations concerning learning processes and desired learning outcomes. These have implications for the roles and relationships between the learners and those who support the learners, whether through teaching, IT support, or in other ways. Expectations may also be changing concerning the content of learning, reflecting both changing labour market needs in terms of graduate jobs and, in many countries, the growing costs of higher education for the learners.

3.1.3. Open questions for the future of teaching and learning in higher education

Many of the question marks for the future of teaching and learning in higher education inevitably have to do with the extent to which online learning, and MOOCs in particular, will have an impact on the traditional structures of higher education. Even for those institutions which are not intending to engage with these new forms of education, there is the potential competitiveness which will come from this provision, with obvious implications for the levels of demand for the more traditional forms. While it is certainly too early to come to firm conclusions about outcomes and indeed the future of MOOCs, four themes (Jordan, 2013; Yuan 2013) appear of great relevance for the future:

- Sustainability;
- Pedagogy;
- Quality and completion rates;
- Assessment and credit.

The **sustainability** question has been raised by a number of commentators: how, given that MOOCs are 'free', can significant revenue be generated? We are now seeing the development of a number of potential approaches to developing revenue streams, particularly from Coursera (see also the analysis from Moody's on the potential impact particularly on the US higher education sector (Kedem, 2012)).

The debate about **pedagogy** is ongoing and is at the heart of the xMOOC/cMOOC distinction (Downes, 2013a). There have been criticisms of the pedagogic model of some Stanford MOOCs, but refreshingly they have shown themselves to be open and responsive to such challenges (Angrymath, 2012; Thrun, 2013).

Quality issues are gaining increased attention and in particular through the EFQUEL MOOC quality Project (EFQUEL, 2013). MOOC providers and participating institutions are developing appropriate quality mechanisms (Edinburgh, 2013).

Assessment and the awarding of credit, particularly though partnerships, is seen as a key route both to open up opportunity and to provide revenues streams. The recent partnership between Coursera and US state-wide institutions may be an indicator of this (Coursera, 2013).

3.2 Findings from the case studies related to teaching and learning

Four case studies examine the theme of innovation in teaching and learning: two case studies analyse the emergence and development of MOOCs in the US and in Europe respectively; the third is the case of the Olin College of Engineering that illustrates how a single new specialist institution with a broad, institution-wide innovation agenda in one professional area has developed its innovative curriculum and engagement with students; and the fourth is the case of the Bavarian Virtual University, which is a network of diverse higher education institutions within a particular region supporting cross-institutional collaboration and providing, through blended learning, new opportunities for students across all subjects.

A short summary of the case studies related to innovation in teaching and learning[14] is highlighted below, while the remainder of the chapter analyses the main points emerging from these cases.

Olin College of Engineering: this case study focuses on the approach to teaching and learning adopted at Olin. In particular, it provides an account of Olin's interdisciplinary curriculum that is built around the 'Olin Triangle', which includes studies in Science and Engineering, Business & Entrepreneurship, and Arts/Humanities/Social Sciences in collaboration with two neighbouring colleges, one specialised in Business (Babson College) and one in liberal arts (Wellesley Colleges). The aim of Olin is to produce graduates who have robust technical skills, the ability to apply engineering concepts to real problems, an interdisciplinary orientation and extensive design experience.

Bavaria Virtual University (BVU): this case study provides an example of education-focused cooperation between the state-funded universities in Bavaria. The BVU promotes and coordinates the development and implementation of tailor-made online course offerings at Bavarian universities for students (for free) and others (low fee). Online courses are developed according to 'blended learning at macro level', meaning that the course (micro-level) needs to be completely online so that it can be used in the study programmes of all universities. However, the BVU does not provide a complete online study programme: study programmes (macro-level) are therefore blended, as parts are traditional face-to-face courses and others are online courses.

US-originated MOOCs: the case study focuses on Coursera, Udacity and NovoEd, venture capital-backed education companies spun off from Stanford University offering online learning at low- or no- cost to thousands of students across the globe through

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[14] Full case study monographs are available in an Annex to the report

partnerships with several universities. All are very young companies (Udacity was launched in January 2012, Coursera in April 2012 and NovoED in April 2013) and are founded by Stanford professors. All companies have a close connection with Stanford and the entrepreneurial and venture capital community of Silicon Valley, which had a key role in their creation and dynamic growth. The companies share a common belief in their role to bring accessible, affordable, engaging, and effective higher education to the world.

EU-originated MOOCs: the case study examines three initiatives at different stages of development. FutureLearn is a consortium-based MOOC model based mainly on UK universities supported by world-known UK institutions (British Council, British Library and British Museum) and the UK government. It is led by a not for-profit company owned by the UK's Open University, and has been formed as a UK response to large US MOOC providers, particularly Coursera, edX and Udacity. It has high-level political support from the UK Government. By contrast, in Germany, the two cases considered are niche providers with strong regional public sector and private sector support. OpenHPI is a development of Hasso Plattner Institute (HPI) based at the University of Potsdam in Germany. Leuphana is a public university in Northern Germany and it utilised the brand of the Leuphana Digital School as a platform for its online education In January 2013.

3.2.1 Why are innovative practices in teaching and learning put in place? An overview of challenges

The introduction of innovative forms of teaching and learning, be they online (e.g. the MOOCs), face-to-face (e.g. Olin) or a mix of the two (e.g. blended learning at BVU) has been a response to all of the challenges identified in this report: (i) the changing supply of and demand for higher education; (ii) changes in higher education funding; and (iii) pressures from globalisation processes.

The changing supply of and demand for higher education

Higher education institutions' reaction to the changing supply of and demand for higher education is most evident in all of the case studies. Supply-side developments are mainly new technologies that enable online learning through MOOCs and blended learning at BVU, and can impact the entire teaching and learning process, or only part of it.
Demand-side developments can be divided into three broad categories:

1) The changing needs and expectations of students, including lifelong learning, home-based learning and flexibility in the education career, together with the skills sets they have already acquired in the use of new learning technologies Online and blended learning are increasingly important ways of accommodating these changing needs of students and build on existing skills and expectations of a diverse population of students who may be expected to engage with higher education at several stages in their lives.
2) The changing needs and expectations of employers. Problem-based learning (used as a foundation stone for Olin's approach) is an example of an effort made by a higher education institution to build into its curriculum the ability to teach the practical skills demanded by the labour market, that it was felt they were previously lacking. The uncertainties and pace of change in the labour market are also important demand-side

factors. The labour market into which the student enters upon graduation may have changed dramatically after a few years. Can higher education equip the student to cope with the uncertainties of the future?

3) A further set of demands are likely to arise from the requirements of external governmental and regulatory bodies reflecting concerns about higher education as a provider of 'public goods' which may be defined in economic, social and/or cultural terms. In some countries, this is already creating an 'impact agenda' where the wider effects of higher education need to be recognised and, increasingly, to be measured. The flow of public funding into institutions may be strongly affected by the results of these measures.

Changes in higher education funding

This is a second major challenge that higher education institutions responded to by introducing innovative practices in teaching and learning, specifically the use of online learning environments. The provision of private high quality education, at free or low cost, to large numbers of students all over the world and widening access to higher education are main objective of the US and EU MOOCs, as well as the publicly provided provision of BVU. However, the expectations and demands of students may vary between an emphasis upon gaining qualifications, having a worthwhile educational experience (or an enjoyable one (!)), acquiring the skills needed to gain a good job, and much else. Different forms of higher education are likely to meet different expectations and demands. Some of the sources of income to institutions will be very contingent on how successfully these expectations and demands are being met. For many higher education institutions, therefore, a major challenge from changes in funding is the greater uncertainty about both the levels and the sources of future funding. In many national systems, funding is coming from a wider variety of sources, each bringing potentially changing and conflicting demands upon higher education.

Pressures from globalisation processes

Finally, globalisation is also a challenge that has led to the development of innovative forms of teaching and learning. Globalisation has brought with it a weakening of national higher education institution system boundaries, changing criteria of higher education excellence, and competition to recruit international students: MOOCs may be the perfect expression of this 'disruptive enabler', by facilitating the enrolment of tens of thousands of students from all over the world and strengthening the competition between higher education institutions even further. The impact of globalisation on the development of online learning platforms backed by the institutional commitment to attract foreign students emerges as a key principle behind the development of MOOCs both in the US and in Europe. For other forms of higher education provision, there is a need to recognise the greater degrees of international labour mobility, bringing with it a growth in the numbers of internationally mobile students and also a need for all students to receive an education which will be recognised as equipping them for careers within an increasingly global labour market. This might require greater institutional interaction across borders, greater collaboration along with the greater competition, and a need to take account of factors such as student demand, reputational opportunities and risks, research opportunities and the funding possibilities that come from all of these factors.

As indicated previously, the external challenges facing higher education institutions in responding to developments such as globalisation, changing demand and supply, and new funding arrangements, create internal challenges for institutions in terms of their structures

and practices. We consider these below using the higher education innovation system framework.

3.2.2 Impact of teaching and learning innovative practices on the higher education innovation system functions, components and relationships between components

Impact on the higher education system functions

In section 2.3, we described three functions of a higher education system: education, research and service to society ('third mission'). The innovative teaching and learning initiatives described above impact primarily the education function of higher education institutions, but have the potential to spill over to the other higher education system functions as well, in the future. For example, online learning environments are also a test bed for research on the behaviour of online learners (as it emerges from the study of the US MOOCs, OpenHPI and Leuphana). Further, the establishment of online learning environments often require cooperation with entities outside the higher education sector strictly speaking, thus contributing to blurring the university boundaries and encouraging the development of 'third mission' activities.

Impact on higher education system components

As far as the components of a higher education system are concerned, the case studies (Table 4) show a variety of actors involved in the implementation of the initiatives:

Table 4: overview of actors identified in the case studies related to teaching and learning

Initiative	System components
US-MOOCs	Coursera, by far the largest of the three US MOOC providers, currently has over 80 university partners worldwide who use the Coursera platform to deliver their own MOOCs. Other key actors are software corporations, policy-making authorities, academics, Silicon Valley entrepreneurs and venture capitalists. There is a substantial Coursera team of 50 covering engineering, design, course operations, business development, administration and staffing, and this is set to expand substantially in the near future. Udacity partners include software corporations, policy-making authorities, academics, Silicon Valley entrepreneurs and venture capitalists. It has partnerships with other universities and with some major business corporations. NovoEd is a much smaller enterprise whose partner network is still in formation.
EU-MOOCs	FutureLearn has a long list of actors, including: FutureLearn Ltd, the Open University, other university partners, the British Council, the British Library, the British Museum, the UK Government, proctored examination companies, national regulatory bodies, students, academics and employers. However, the roles of many of these actors are currently unclear at this stage. The OpenHPI actors are senior staff of the Hasso Plattner Institute, the SAP-AG business management software company which provides funding, other HPI staff with relevant technological

	expertise, teaching assistants, professors, students and the state of Brandenburg. At Leuphana, students have key roles, working in small teams together internationally using a largely constructivist and connectivist pedagogy, along with Leuphana and other academics with relevant interests and expertise.
BVU	The following main actors are identified: the Bavarian Ministry, the 31 Bavarian universities, the staff of the universities, the BVU and its staff, students, and external experts in course evaluation. Online courses are developed within existing universities by their academic and technical staff and are then made available to students (and others) across the whole of the state.
Olin	While initiated by the endowment of the Foundation and the senior staff of the new college, Olin evolved rapidly into a very collaborative approach with a long list of current actors comprising students, graduates, faculty, administrators, employers, partner institutions and corporate sponsors. The case study report provides a detailed picture of the roles and relationships between the different actors and the strong emphasis on collaboration which these entail. It is interesting to note that the Foundation which established the college has now closed, and the funds and responsibilities have now been transferred to the college itself.

As it emerges clearly from the table above, all of the initiatives include a wide spectrum of actors, direct and indirect, individual and institutional, as summarised in the table below.

Table 5: summary of actors involved in teaching and learning

Actors	Direct	Indirect
Individual	• Students; • Academics; • Administrative staff.	• Venture capitalists; • Software developers; • Employers.
Institutional	• Universities; • Higher education funding councils; • Higher education quality insurance bodies.	• IT companies; • Private companies and foundations; • Regional and national governments.

Impact on the relationships between the higher education system components

At the individual level, all the innovative practices examined (online-learning, blended-learning and problem-based learning) suggest a more cooperative and horizontal relationship between the direct actors, notably academics and students. Students provide more inputs to tasks traditionally performed by academics (e.g. course design, as highlighted in the case of Olin, and peer assessment as in the MOOCs), while academics take part more directly of the learning experience of students, for instance by coaching and mentoring, rather than lecturing only.

At the institutional level, we observe intensified patterns of cooperation in all of the practices examined among direct and indirect actors, including: voluntary cooperation

among higher education institutions; cooperation among higher education institutions initiated by the government; voluntary cooperation among higher education institutions and private companies. For example, the US MOOCs revealed on the one hand financially-driven new partnerships (with various external investors or with the partner universities) involving all the three platform providers and triggering the development of various internal monetization strategies that are currently experimented in each company, and on the other hand, non-financially driven new partnerships (e.g. between the platform providers and Stanford University, within the company institutional teams for advancing the company's strategic and organizational development, etc.).

Increasing cooperation appears thus a mechanism that is adopted to pool existing resources, acquire new resources, and share the risk and also some of the costs incurred by the implementation of innovative teaching and learning practices. Increasing cooperation does not contradict the increasing competition that we also noticed among higher education institutions, as discussed earlier. The two aspects coexist and manifest themselves as distinct individual and institutional responses at different levels and geographic or socio-economic contexts.

Relationships between individuals and institutions are also altered, as it was clear from some forms of conflict between the new and old forms of teaching, learning, university-faculty relationships, university-external technology providers, intellectual property rights, etc. A particularly relevant example in this sense, with the potential to generate even more important changes in the future, is the rise of 'star professors' and the emergence of new configurations of power and privileges top-tier professors may be given in their home higher education institutions vis-à-vis other academic staff, less successfully or not at all involved in online courses. This phenomenon was highlighted by the US MOOCs and was less visible in Europe.

3.2.3 Impact of contextual factors on the innovative teaching and learning practices

The analysis of contextual factors within which the innovative practices in teaching and learning examined here emerged, highlighted two main factors that influenced the shaping up of an innovative practice, namely institutional/regional level factors and systemic/national level institutional factors. The former refer to specific organisational features of a higher education institution interacting with its direct environment that enable the development of an innovative practice, while the latter refer to the broader systemic context descending from the political context within which a higher education institution is embedded.

Institutional factors are salient both in the US and EU MOOCs cases, which exemplify the importance of specific higher education institution's features in the development of an innovation practice, such as the institutional legacy of a university and its independence. For instance, Stanford's own history offers fertile ground for the development of online learning provisions, since these have always been part of the Stanford tradition. Indeed, the first attempts at developing online education date from the 1960s and determined a high degree of openness towards innovation through online teaching and learning that has always been part of the institution. Similarly, the EU MOOCs reveal that a long tradition of online learning within the Open University was a key motivation for the Open University to lead on the development of FutureLearn. Institutional independence also stems out as an important institutional feature that favours innovation. This aspect emerges as particularly relevant in the case of OpenHPI,

which acts as a private institution within a public body. Innovations that spin off as the outcome of a favourable institution-level environment (be it the institution's independence, its long tradition in innovating, or a mix of the two) tend to start as bottom-up localised initiatives whose breadth may remain limited (e.g. the two German MOOCs examined) or develop into larger initiatives (e.g. courses being joined by over 80 higher education institutions) and attract institutional backing (e.g. the support received from the UK government by FutureLearn) or support from the private sector (e.g. Silicon Valley venture capitalists in the case of Stanford).

System or national-level factors have been highlighted by the BVU case, which appeared to be shaped by a significantly different context. Here, it is the systemic context that seems most relevant. The BVU is an example of a top-down initiative stemming out of a stable political context at the State level and a stable public funding that allowed a large consortium of universities to cooperate in the education sector. It is noteworthy that BVU is entirely government- funded and driven and it started off as a large cooperative initiative.

The interplay between institutional/regional and systemic/national factors actually reflects a continuum ranging between top-down and bottom-up approaches, as well as localised and large-scale innovations.

3.2.4 Outcomes and blockages of the teaching and learning innovative practices

The outcomes[15] of the teaching and learning initiatives analysed under this theme are very diverse, entailing:

- The extent of partnerships involved (e.g. large international partnership in the case of Coursera covering 83 associated higher education institutions, large national partnerships in the case of BVU and FutureLearn, localised initiatives in the case of OpenHPI, Olin, and Leuphana);
- The size of the student cohort (e.g. Coursera has over 4 million students, Olin 300)
- Course formats (e.g. entirely online for MOOCs, blended in the case of BVU, face-to-face at Olin);
- Course range (e.g. over 400 subjects in the case of Coursera, very specialised education in the case of engineering at Olin);
- Accreditation (e.g. standard accreditation measures in the case of Olin, a still not completely defined framework in the case of the MOOCs);
- Assessment (e.g. standard teacher's assessment in the case of BVU, peer-assessment in the case of the US MOOCs).

Despite the great diversity in outcomes to date, there are two general outcomes that are common to and cut across the different initiatives and are worth highlighting:

1) **The focus on a student-centred vision of teaching and learning**: all the initiatives assign a very central role to the student. For example, at Olin, students participate in the design of the curriculum and in Olin's specific approach of 'constructing knowledge'; in the

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[15] Detailed facts and figures on each of the case studies are provided in the case study monographs

US-MOOCs peer assessment is a central component of the pedagogical model, thus assigning a role to students that goes beyond that of being a passive recipient of knowledge to actually participating actively in the learning process also through assessing their peers. Similarly, one of the BVU objectives is to provide students with more choice and flexibility, a feature common to the MOOCs initiatives as well. It is clear from the studies that while technology is a significant enabler of these initiatives, they are not driven by technology only. Rather, they develop through the vision and interaction of a range of actors seeking to address significant educational questions.

2) **The intense collaborative processes established within and beyond the higher education sector**: it has been observed that partnerships, networking and collaboration are optimal institutional set-ups through which innovative teaching and learning is delivered. This entails collaboration among higher education institutions (e.g. BVU, Olin, FutureLearn) as well as with other partners (e.g. private companies in the case of the MOOCs, regional government in the case of BVU). Collaborative relationships allow each partner to exploit each other's strengths and – strictly related to the previous point – meet the demands of an increasingly diverse body of students (or more broadly consumers) and employers.

Some blockages to a fully-fledged expansion of innovative practices in teaching and learning have been also observed. Again, moving beyond the specifics of each case study, two main issues emerge:

1) **Resistance to change at the institutional-level**: in several case studies, especially those largely driven by bottom-up initiatives, resistance to change was a notable phenomenon, as the innovations tend to change existing and established relationships among actors. In the case of Olin, an initial opposition on the side of academics to changing their role from lecturing to coaching and mentoring was observed. Similarly, a degree of scepticism towards online teaching and learning has been noted in our MOOCs case studies, a phenomenon that is also more broadly documented in other sources (e.g. Economist, 2013: 51). The resistance to the change induced by innovations and innovators within institutions is therefore a potential blockage that prevents the unfolding of innovative practices in teaching and learning at full potential, at least in the initial stages.

2) **Lack of appropriate regulatory frameworks at the macro-level**: this second blockage mostly applies to online learning. As a fast developing initiative, it has been noted that some online learning provision is not embedded in a suitable regulatory framework. Issues stemming from unclear quality assurance and recognition of credits are central elements which will need a solution at the macro-level (although piece meal legislations have been already been implemented in this respect, e.g. in California) in order to provide a stable and certain environment for both institutions and users of online learning. A similar line of argument runs for the regulation of intellectual property rights, which are not always clear at present.

3.3 Concluding remarks concerning innovative practices in teaching and learning

This section discussed how innovative ways of teaching and learning, be they online, forms of blended learning, or problem-based learning, are important tools that higher education institutions may resort to in order to address the overarching challenges of globalisation, changing supply of and demand for higher education, and changes in funding that have been identified. It has also been discussed how a fully-fledged development of these innovative

practices, especially in the early stages, may be hampered by institution- and system- level blockages. Drawing on this discussion, the following recommendations appear to be relevant for a successful development of innovative teaching and learning.

At the level of higher education institutions, the following measures are recommended for consideration:

- Nurture an institutional culture to innovation that enhances creativity, creates awareness of the benefits resulting from the implementation of the innovation, stimulates openness to innovation and minimises resistance to change;
- Consider incentives and rewards for members of staff (including but not limited to academics) who engage in innovative practices;
- Engage faculty members in exploiting the potential of new learning technologies
- Consider the use of cross-institutional collaboration to improve student choice and quality (and possibly cut costs);
- Put in place adequate measures for skills development of teaching staff and also for greater collaboration in performing their teaching duties;
- Review existing organisational boundaries and linkages.

At the level of regional, national and supra-national policy-making institutions, the following measure is recommended for consideration:

- The establishment of a clear regulatory framework that addresses blockages that online learning is faced with today, namely: quality assurance mechanisms, credit recognition processes and intellectual property right regulations.

4. Improving student performance through technology

4.1 Overview

A major development in mapping and monitoring student performance in higher education is the use of tools such as Learning Analytics and Academic Analytics.

Learning Analytics is an important area for innovation and development in educational systems. Learning Analytics is in itself not a new research area; it builds on developments from a number of related fields and synthesizes several existing techniques (Chatti et al., 2012). The New Media Consortium (NMC) Horizon report (2013) identified Learning Analytics as a key emerging technology with a predicted widespread adoption in the next 2 to 3 years. The NMC report defines Learning Analytics as 'the field associated with deciphering trends and patterns from educational big data, or huge sets of student -related data, to further the advancement of a personalized, supportive system of higher education.' This definition identifies two key facets of Learning Analytics. First, there is the identification of trends and patterns from large datasets, and secondly, the use of this analysis to 'personalise' learning and support for students. It is important to emphasise that although Learning Analytics may be dealing with 'big' data, its output can impact at an individual level. Through the use of data and models to predict student progress and performance, institutions then have the ability to act on that information with the possibility, for example, of providing additional support to a student who otherwise may be at risk.

The development of Learning Analytics

Learning Analytics can be viewed as a specific example of application of analytics to the particular domain of learning and education. Broadly, analytics is defined as 'the use of data, statistical analysis, and explanatory and predictive models to gain insights and act on complex issues' (Bichsel, 2012). Many of the techniques used by Learning Analytics have been developed for business and commerce. Businesses employ analytics to gain insights from their customer data, to identify patterns of behaviour, to provide recommendations and to support advertising strategies.

When assessing in which context the use of Learning Analytics emerges, there is not a single set of factors that can be identified as preconditions. Even more, its emergence to date depends more on individuals and personal interests than institutional or regulatory policies. An essential precondition to develop a Learning Analytics system is the use of online learning platforms such as Blackboard or a MOOC environment. A close investigation is however needed to distil what kind of data can be obtained from these platforms and what data is needed for providing valuable feedback. Therefore, before being scaled and implemented top-down, the innovation focuses on detailed ground-work and continuous experimentation (trail-and-error) to identify what data is needed and how feedback should be provided to students.

Chatti et al. (2012) identify a range of fields that Learning Analytics draws upon. The first is Academic Analytics (Goldstein and Katz, 2005), which is used to describe the application of business intelligence tools and practices in higher education but at an institutional or systems level. Secondly, Learning Analytics draws heavily on data mining techniques, now widely used by government and business, more specifically on educational data mining methodologies (Romero and Ventura, 2007). A third area is that of the so-called 'recommender systems',

which aggregate data about users' behaviour or preferences in order to draw conclusions for recommendation of items of relevance to the user. Such systems are widely used in E-commerce (e.g. Amazon) and in social networks (the 'like' feature). Recommender systems are used in some Learning Management Systems and library systems, but as Chatti et al. point out, there are open research questions over how algorithms and methods need to be adapted and optimized in order to be transferred successfully from the domain of commercial recommendations to Learning Analytics.

Learning Analytics and Academic Analytics

The relation between Learning Analytics and Academic Analytics is worth examining in more detail. Learning Analytics focuses on the learning process, while Academic Analytics reflects the role of institutional data analysis on student and institutional performance at an institutional, regional, national and international level (Siemens and Long, 2011). The distinction is an important one, as data collection for comparative purposes on educational institutions and systems is certainly not new, while the focus of Learning Analytics on the learning process, particularly as mediated through online technologies, does offer an innovative dimension and can potentially inform and influence key decisions made by students, academics and many other stakeholders. In so doing, it can also help to individualise experiences which are more collective in traditional educational settings.

Learning Analytics can be used to support relatively traditional models of teaching and learning, while enhancing their efficiency but they also have the potential to restructure the process of teaching, learning and administration, even though this possibility is still 'future focussed' (Siemens, 2010). Rather than the use of a uniform pre-planned curriculum as is generally the case now, 'learning content should be more like computation – a real-time rendering of learning resources and social suggestions based on the profile of a learner, her conceptual understanding of a subject, and her previous experience' (ibid.).

4.1.1 Challenges driving the use of technology to improve students' performance

The development of Learning Analytics lies at the intersection between the changing supply of and demand for higher education, and as well as the changes in funding structures and the pressure that higher education institutions have to find efficient ways of implementing traditional tasks. Three key issues identified by Ferguson (2012) are firmly grounded in such challenges.

With respect to supply-side challenges, the growth of 'big data' in educational systems has now become a reality. The development and widespread adoption of Virtual Learning Environments (VLEs) or Learning Management Systems (LMS) mean that educational institutions now potentially have large amounts of data, tracking and monitoring the performance of individual students and cohorts. VLEs do contain some tracking and reporting features, but it is only recently that system providers are beginning to explore the potential offered by their systems for Learning Analytics (Blackboard, 2012). To a considerable extent, the challenge now is to put to good use these 'big data'.

With respect to demand-side challenges, it has already been noted a tremendous growth of online learning. It is argued that Learning Analytics has a key role to play here, for instance

MOOC providers are using Learning Analytics approaches, such as recommender systems and peer review-based on crowd-sourcing techniques as part of their course provision to their students (Coursera, 2013). Issues related to student motivation and engagement with online learning (Simpson and Simpson, 2002) include how institutions and teachers can best monitor and indeed teach online, or how analytic techniques can be used to help teachers faced with perhaps hundreds of student responses in an online forum (Dringus and Ellis, 2005). In considering the challenges for more traditional educational settings, questions arise about how new data will inform and change key decisions and processes, alter relationships between key actors, and change fundamentally key elements in the learning experiences of all students.

With respect to the funding aspects, Learning Analytics represents a viable option to meet in an efficient way the increasing demand for educational institutions to measure, demonstrate and improve performance. In particular, demand side considerations also include the growing need and opportunities for students to make informed decisions about their choice of study, their approach to learning and their performance levels. These factors reflect the growing consumerist emphasis in many higher education systems and the shift from more teacher-centred to more student-centred arrangements. Further, students (both as learners and as consumers) are bringing increasingly developed skill sets and technological competencies with them when they enter higher education.

Alongside the opportunities for improving the performance and experiences of students which the new technologies provide comes a set of more internal challenges to be faced by institutions in changing their institutional practices and traditions to enable the opportunities to be achieved. These are addressed in the next sections.

4.1.2 Actors, roles, institutional processes

Learning Analytics has much to offer the **student**. In large-scale higher education systems, with many students enrolled in courses, it gives potential for greater individualisation, choice and diversity. Latour (2013) has summarised the benefits of Learning Analytics from a student perspective. It enables them to reflect on their own learning and on the learning of others, have a personalisation of the learning experience including content adaption, and facilitate learning at the student's own pace. In summary, Learning Analytics can provide insight to the student on their learning in the past to benefit learning in the future. To some extent, Learning Analytics may involve a transfer of power and decision-making away from the academic/institution to the student/consumer.

Through use of analytics, **teachers,** will be able to gain a much clearer example of student engagement and performance, even in large online systems. Wolff and Zdrahal (2012) report on a system developed at the British Open University that enables lecturers to track the individual performance of students through a sophisticated system of 'traffic light' indications, where a 'red light' indicates a lack of student engagement and possible problems. Dringus and Ellis (2005) show how teachers can better understand large online forums of postings by students. Furthermore, Learning Analytics should be seen in close relationship with Instructional Design[16], meaning that Learning Analytics practices should commence with clear ideas about the instructional practice and course design. Learning analytics therefore impacts

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[16] http://lasiamsterdam.wordpress.com/resources/instructional-design/

the way teachers design there courses, as it becomes clear that students learn better when the course is designed differently.

Institutions can monitor the students' performance in terms of dropout and progression rates on a much more fine-grained level. They can thus evaluate their courses and improve outcomes for students (Greller and Drachsler, 2012). This will not be achieved simply by investing in the appropriate technology, rather a strong institutional commitment to implement processes and systems that will enable the institution to provide appropriate and effective support based on learning analytic insights is required. Siemens and Long (2011) point to the difficulties faced by administrators and decision-makers who are confronted with tremendous uncertainty in the face of budget cuts and global competition in higher education: 'Learning analytics can penetrate the fog of uncertainty around how to allocate resources, develop competitive advantages, and most important, improve the quality and value of the learning experience.' This does raise the possibility of the misuse of analytics: 'Data can easily be abused as supporting evidence for exercising inappropriate pressures on data subjects to change otherwise perfectly acceptable or explainable performance behaviour'(Greller and Drachsler, 2012).

Commercial organisations are key stakeholders in processes that potentially increase employability. It is worth noting that the University of Phoenix and other for-profit higher education institutions that emphasise employability consistently make use of artificial intelligence and predictive modelling techniques and that they have shaped their cultures around performance (Elias, 2011). Major LMS providers are now developing analytic features. For example, Blackboard Analytics is a suite of data warehousing and analytics products that supplies Academic and Learning Analytics (Blackboard, 2013). Another LMS provider, 'Desire to learn' is developing Student Success Stories (S3): 'The core of S3 is a flexible predictive modelling engine that uses machine intelligence and statistical techniques to identify at-risk students pre-emptively. S3 also provides a set of advanced data visualizations for reaching diagnostic insights and a case management tool for managing interventions' (Ellis, 2012). Knewton has developed a number of approaches ranging from the provision of Learning Analytics, then using these analytics to provide students with targeted recommendations and through to fully adaptive coursework for individual students. They are now partnering with major publishers to develop resources to support adaptive learning (Knewton, 2013).

Learning Analytics can be seen as an element in the 'unbundling' of higher education components (Shirky, 2012). The establishment of large data stores comprising performance data from huge cohorts of students potentially raises many issues in relation to their commercial use (Ravitch, 2013).

Government and regional organizations generally have an interest in Academic Analytics rather than Learning Analytics. Their concerns are with educational performance and general improvement measures, rather than a more fine-grained analysis of Learning Analytics. However, this distinction is by no means clear-cut. The ability of Learning Analytics to identify students at risk and potentially reduce dropout for example (Van Harmelen and Workman, 2013) and to enhance employability are clearly relevant.

The application of new technologies through approaches such as Learning Analytics has the potential to change relationships between the key actors within higher education, liberating

some while constraining others. In some ways, it brings more business approaches to the work of higher education institutions, providing greater consumer choice and diversity. A major challenge may be whether these developments will tend to complement or rather replace the traditional professional authority of academics over the educational experiences of students.

4.1.3 Open questions for the future of using technology to improve student performance

As discussed in the previous chapter with respect to MOOCs, there are also a number of open questions that affect the future development of learning analytics (Ferguson, 2012), including:

- The connection with the learning sciences;
- A better understanding of learners' motivations and needs;
- The use of data within a clear framework of ethical guidelines.

How can we build strong connections with the learning sciences? This question is flagging up the important issue that while much of value may be imported from analytic work undertaken in the commercial field, Learning Analytics techniques and methods need to be fully grounded in understanding of learning and pedagogy: 'As Learning Analytics emerge from the wide fields of analytics and data mining, disambiguating themselves from academic analytics and EDM, researchers will need to build strong connections with the learning sciences' (Ferguson, 2012). Learning analytics will need to develop strong links with areas such as Learning Design (Laurillard 2012), and this process will be very much a 'two-way street', whereby the different domains support and enrich each other.

How can we better capture the motivations and the needs of learners? Learning Analytics can be extended beyond a concentration on questions such as grades and student retention to a more rounded perspective including enhancing motivation, developing confidence and meeting career goals: 'A focus on the perspectives of learners will be essential to the development of analytics related to their needs, rather than to the needs of institutions' (Ferguson, 2012). This wider perspective on Learning Analytics is more aligned to Siemens (2010) transformational view. In order for this to happen higher education institutions will need to provide the processes, tools, support and resources to help the teaching staff with the interpretation of analytic outcomes and with the further development of student focused resources.

How can we develop and apply a clear set of ethical guidelines? This issue revolves around the ownership and stewardship of data and the rights of learners. In the US there are specific concerns over recent legislation that enables organizations to accumulate and store personal, confidential data about every public school student. Critics argue that this has potential for undesirable exploitation (Ravitch, 2013), a concern that is widely shared. Ferguson (2012) argues for the need to create a clear ethical framework for the use of such data, in relation to students' responsibilities to act upon recommendations supplied by Learning Analytics, and for researchers to have clear ethical procedures in relation to the use of analytic data.

4.2 Findings from the case studies related to technology and student performance in higher education

Two case studies have explored this theme. The first encompasses the experiences of three universities (Purdue University, University of Amsterdam and Derby University) and focuses on the application of Learning Analytics to enhance student performance by providing better information to inform decision-making which can enhance learning. The second case study - the eAdvisor at Arizona State University, focuses on informing student choice of 'majors' and facilitating decisions which have important implications for student performance and learning outcomes. This second case study falls within the Learning Analytics as it also makes use of data to improve students' choice and ultimately contribute to increased retention rate.

A short summary of the case studies related to technology and student performance in higher education[17] is highlighted below, while the remainder of the chapter analyses the main points emerging from these cases.

Learning Analytics at Purdue University, the University of Derby, and the University of Amsterdam: This case study examines innovative approaches to the use of student data to inform decision-making by the use of Learning Analytics across three universities. The concrete examples which are:

- Purdue University (US) has implemented Course Signals to increase student success in the classroom. Purdue University's Course Signals application detects early warning signs and provides intervention to students who may not be performing to the best of their abilities before they reach a critical point. Course Signals is easy to use, it provides real-time, frequent and ongoing feedback. Furthermore, interventions start early - as early as the second week of class;
- The University of Derby (UK) explored the strategies to improve student enhancement processes by addressing key questions such as: (i) What is actually happening to students, how can we find out? (ii) What are the touch points between students and the institution? (iii) What are the institutional 'digital footprints' of the students? (iv) What really matters to students?;
- The Dutch University of Amsterdam (UvA) and the Free University of Amsterdam (VU) received a fund from SURF to conduct a pilot study on user requirements for Learning Analytics. It looked into ways to use data to make visualisations to inform teachers on (i) the use of e-learning material by students; (ii) the order in which the learning material is used; and (iii) whether there is a relationship between the number of materials used and the study results.

The eAdvisor at Arizona State University (ASU): The eAdvisor is Arizona State University's electronic advising and degree tracking system. It uses modern technology and data analytics to help students find majors that best fit their interests and thus ensure they have the highest likelihood to graduate. The key objectives of the initiative are to increase the student retention and graduation rate, provide quality education at affordable costs to an ever increasing number of students.

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[17] Full case study monographs are available in Annex to the report

4.2.1 Why are innovative practices related to technology and student performance in higher education put in place? An overview of challenges

The answer to the 'why' question is closely related to two of the challenges identified in the literature: (i) the changing supply of and demand for higher education; and (ii) changes in higher education funding.

The changing supply of and demand for higher education

The Learning Analytics cases come as an institutional response to changing and diverse user/consumer (student) needs and expectations, and the consequent need for new approaches to maintaining and enhancing the quality of the student experience and performance. Also, one important aim of the eAdvisor is to improve completion rates, both to the benefit of the students themselves and to the benefit of the university in financial terms, due to the resulting increase in enrolments in later years of the course. While the focus of innovation is on the specific issue of achieving better informed student choices of 'majors', this is part of a larger 'quality improvement' agenda, involving not only increased retention rates, but improved student-centred learning processes, on-line advice and support, greater student freedom and choice of curriculum, greater employability and cost savings to the institution. These developments reflect both a growth in student 'consumerism' and a greater 'competitiveness' in the higher education 'marketplace'. Thus, there are both educational and commercial reasons for institutions to innovate in the ways in which they support and inform their students.

Changes in higher education funding

The quest to increase retention rates via innovative practices related to technology and student performance is in both cases (Learning Analytics and eAdvisor) also a response to changes in higher education funding. As already mentioned, increased retention rates are both beneficial for the student and for the institution.

The Learning Analytics cases and the eAdvisor are also a good illustration of the current and future challenges identified by Ferguson (2012): firstly, all cases struggle with dealing with the 'big data' available to track student performance. It is not a question of whether data is available, but of which data is best to use to support students. Secondly, Learning Analytics allows higher education institutions to better use the increasing volumes of online learning and to track student performance even when students are not physically present. Finally, Learning Analytics is used (or has the potential) to increase the efficiency in higher education.

Again, the innovation initiative meets challenges of implementation which need to be overcome if it is going to succeed. These are considered below.

4.2.2 Impact of technology and student performance practices on the higher education innovation system functions, components and relationships between components

Impact on the higher education system functions

All the case studies examined under this theme address the education function of the higher education system, but from different angles. For example, the Learning Analytics cases address the actual delivery of teaching and student-teacher interaction. There is a complaint raised in general (as mentioned in all three cases) that students, especially when entering university, are not accustomed to self-directed learning, perpetuated by a lack of personal interaction between student and teacher which they were familiar with in secondary education. Teachers do not have the time to get to know each student, let alone provide personal feedback on their progress made. This lack of interaction can result in a lack of engagement with learning, and insecurity on when students should start learning for their exams. Learning Analytics systems can help students to acquaint themselves with university life and become better self-directed learners. In addition, teachers can use the data to monitor student progress and track where they have difficulties grasping the material and by improving the course and their feedback to students, increase retention rates. In more advanced systems (e.g. Purdue), the Learning Analytics system is used to reflect on course structure and quality. As expressed by a faculty member, professors tend to get a bit lazy when it comes to reflecting on own course if they have been giving the course for years. The Learning Analytics system provides systematic feedback on what can be improved and what is difficult for students to grasp. Learning Analytics can in that sense be seen as a lesson in pedagogy for academics: in many countries, university teachers have never been taught in pedagogy and didactics.

The eAdvisor focuses on several other aspects of the education function: advising students on their learning trajectories and choices, by allowing students to choose the major that is best suited for them and providing warnings in case the student appears to be off-track; i.e. offering opportunities for course development, based on student feedback on various courses; and facilitating student mobility through a number of specific functions.

Impact on higher education system components

The most significant impact of the innovative practices is an intensified involvement of direct and individual actors at the institutional level within higher education institutions, such as students, academics (faculty members) and administrators / IT staff mostly and senior management. Other indirect actors (in the case of eAdvisor) include community colleges, foundations and private firms that provide funding to the initiative. The impact on the different stakeholders involved is a general widening of their perspective, blurring of institutional demarcation lines and through this a more differentiated pallet of activities. For instance, IT staff are involved in quality assurance, faculty are involved in defining criteria for progression.

In all cases, the presence of 'innovation champions' is noteworthy, in the sense of the impact of people who are committed to 'quality improvement', whether in terms of improved retention, better performance, new forms of (more self-directed) student engagement, or some combination of all three. In all three institutional examples, the emphasis is upon 'bottom-up' commitment and initiative in some cases supported by external organisations.

Impact on the relationships between the higher education system components

The most significant impact of the cases is an intensified participation of and cooperation among various different types of actors, institutional and individual, direct and indirect (students, academics, student support staff, IT support staff, policy-makers, etc.) as a

prerequisite for success. Within the eAdvisor, collaboration with external bodies is aimed to provide financial support for the initiative and its implementation (for example, with the eAdvice service extended to community colleges and other institutions).

All cases are characterised by their interdisciplinary nature and blurring of responsibilities and lines of autonomy. The intensified cooperation impacts the activities of all individual actors. For instance, in relation to the Learning Analytics cases, the systems impact the course design and autonomy of the faculty: the analytics reveal weaknesses in the course, which the teacher can/ should take on board to improve the course. Another example is the IT staffs, which needs to develop sensitivity for how messages are received by students. It is one thing to develop the IT system behind it, but the communication-element is just as important. With regard to changing relationships, the following can be stated in relation to the eAdvisor:

- The eAdvisor facilitated the interaction between the student and the academic advisor in terms of the choice of a major, tracking student progress and finding solutions for the student in case of going off track;
- The eAdvisor facilitated the allocation of university facilities and instructors (e.g. number of seats and instructors for critical courses, cleaning of courses that are low in demand, etc.);
- The eAdvisor transfer of students facilitated the transfer of student records from the community college to Arizona State University. Any change in the student profile is immediately visible in the system.

4.2.3 Impact of contextual factors on the initiatives related to technology and student performance in higher education

When assessing the impact of contextual factors on the three Learning Analytics cases, it is interesting to note that several factors can be identified as preconditions. The emergence of Learning Analytics appeared to be more influenced by individuals and personal interests than by institutional or regulatory policies, on top of the essential precondition to use online learning platforms such as Blackboard or a MOOC platform. A close investigation is, however, needed to distil what kind of data can be obtained from these platforms and what data is needed for providing valuable feedback. Therefore, before being scaled and implemented more widely, the innovation is based on detailed ground-work and continuous experimentation (trial-and-error). At Purdue University, developments started very low-profile by a small group around John Campbell, an IT-interested academic. The work continued in the ITaP group (Information Technology at Purdue). In Amsterdam and Derby, subsidy programmes (respectively from SURF[18] and JISC[19]) were used to experiment with Learning Analytics at a small scale in an institution. Although these subsidies are rather modest, they created momentum within the institution that Learning Analytics is an interesting new phenomenon to work on. A common key contextual factor in all three Learning Analytics cases is that persons from different disciplines are involved early on: IT specialists, faculty staff, administrators and decision makers. The institutional context of the organisations enables these different stakeholders to cooperate by embedding innovation in the strategy of the higher education institution.

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[18] http://www.surf.nl/
[19] http://www.jisc.ac.uk/

The outcomes of the Learning Analytics initiative will partly be shaped by local contextual circumstances or institutional mission. Thus, the British university with the strong emphasis on recruiting 'non-traditional' students has particular concerns about coping with diversity, with different forms of student engagement and motivation, identifying 'at risk' students. These factors have led to the concept of a 'customised data dashboard' to be developed to meet the diverse user needs. It takes a rather broader concept of the student experience than would be the case within different types of institution. Accordingly, this initiative can be relevant to the larger issues of higher education differentiation by providing institutions with the tools to achieve their own distinctive mission and to meet the increasingly diverse needs and circumstances of their students.

Similarly, also the eAdvisor is positioned in an institutional mission and vision. Arizona State University is one of the 'Next Gen U', which have been successfully utilising technology to improve learning and manage costs (Fishman, 2013) and made its mark as 'a hot-bed of data-driven experiments' (Parry, 2012). In his inaugural address in 2002, Arizona State University President Michael Crow stated the university's commitment to the success of each unique student as one of his primary goals. This goal has been pursued steadfastly, through expanding university access and graduating more college graduates with higher capacity to fuel the state's and the nation's economic engine. President Crow organised a team dedicated to transforming Arizona State University's vision from 'school-centred' to 'student-centred' and 'customized education,' led by Executive Vice President and Provost Elizabeth Phillips. The team focused on creating new programmes, personalised learning technologies, an online learning environment and innovative transfer partnerships to give Arizona State University students an educational experience focused on developing their talents and aptitudes and preparing them to graduate and enter the workforce or further their education (Arizona State University ASU Annual Report 2012).

To conclude, our case studies suggest that the success of technology-enabled innovative practices aimed to improve student performance does not depend on a particular regulatory or political context that favours the development of such initiatives, but it is rather related to the strength of the institutional support given to what usually starts as a bottom-up endeavour bringing together different institutional stakeholders, enhanced by top-down incentives provided via funding arrangement to subsidize small-scale experimentation before being scaled and implemented more widely within the institute.

4.2.4 Outcomes and blockages of practices related to technology and student performance in higher education

The outcomes of all cases studied show that data mining is used to build a more student-centred approach to education. Academics and educators mostly benefit from it by understanding better how students interact and relate to coursework, while students can access specific data tailored to their needs. Only at one of the three institutions does Learning Analytics appear to have become firmly embedded, with some quite impressive student performance improvements to report (Purdue University's Course Signals). A notion of 'actionable intelligence' available to different groups of actors within a larger 'quality improvement' vision appears to be coming firmly embedded. Course Signals appears to be particularly effective for first-year students to support them in becoming self-directed learners.

Research indicates that courses that implement Course Signals realize a strong increase in satisfactory grades, and a decrease in unsatisfactory grades and withdrawals (Arnold; Pistilli, 2012). According to the analysis of Arnold and Pistilli (2012), students report positive experiences with Course Signals overall. The computer-generated e-mails and warnings, shaped as personal messages seem to minimize their feelings of 'being just a number,' which is particularly common among first-semester students. Students also find the visual indicator of the traffic signal, combined with instructor communication, to be informative (they learn where to go to get help) and motivating. At the other institutions, the initiative seems to have more of a 'project' status, but in general there is evidence of positive changes in attitudes, behaviour and relationships across the institutions. Actors are both better informed and better motivated as a result.

In relation to the eAdvisor, concrete outcomes achieved to date are improved retention rates linked to increased revenue from larger student numbers. The eAdvisor is now also operating in community colleges in the region, thus extending opportunity and mobility more broadly beyond the university. At the managerial level, the eAdvisor makes an important contribution to improved performance and resource management within the institution. At the University of Florida, the eAdvisor resulted in a 20% increase in the graduation rate. At Arizona State University, the system has started to be implemented in the academic year 2008-9 and it has already resulted in an 8% improvement in the student retention rate, from 76% to 84%. With a first-year class of approximately 9,000 students, this increase is translated into an additional 720 students a year advancing from freshman to sophomore year, who otherwise might have dropped out (Arizona State University News, 2011). Each percentage point increase in the retention rate generates approximately $1.7 million in recurring increased revenues for Arizona State University, while greatly increasing the likelihood that those retained students will graduate (Phillips, 2013). The four-year graduation rate increased from 32% for the fall 2005 cohort (before the eAdvisor) to 42% for the most recent cohort (fall 2008) (Philips, 2013). After the introduction of the eAdvisor, students are much more on track and the quality of the academic advising has improved, with the academic advisors having better knowledge about the reasons for students going off track.

In terms of blockages, the most important ones reported in establishing Learning Analytics systems are listed below:

- Insufficient correlation between institutional and student data: institutional data and student data are stored in different 'silos' which do not communicate easily. Each department has its own data silo, online platforms store their data differently, administrative data are stored by central units and some data come from other sources;
- Data adequacy for establishing a student profile: The key question is not whether enough data is available, but what data are necessary to provide a risk profile of a student;
- Availability of skilled people and a shared vision: Learning Analytics requires a team of people with different backgrounds. A bottleneck is that the stakeholders might have slightly different ideas and objectives, and communicate in a different language. In addition, initiatives cross hierarchical institutional structures;
- Insufficient engagement of faculty staff: Initiatives need individuals who believe in Learning Analytics and early adopters among faculty staff. If these are absent, developments will not result in working systems. Convincing other faculty members remains difficult, even in advanced initiatives as at Purdue University. A reason for this is the implicit academic

attitude that a course belongs to the professor and that external interference in the course structure and quality is avoided. Teachers using Learning Analytics systems need to be trained, meaning that they need to be trained in being a teacher, willing to adapt the course to the specific needs of the students;

- Ethical questions on big data: Although currently not leading to difficulties, an issue which is becoming more and more important is the ethical question related to big data. On the one hand, institutions are required to use data to offer the best possible education; on the other hand, privacy laws might forbid them in using and linking different data silos.

The blockages in the development of the eAdvisor concerned the technical complexity of the online system, the need for permanent updates of the system with the related databases (e.g. national employment and salary statistics), low awareness of potential students on the requirements of academic life, choice of a major, etc.

4.3 Concluding remarks on technology and student performance in higher education

Innovation as something 'new' or something 'improved'? The case studies examined in this section are surely an example of the latter. All institutions collect data on their students, but what is collected and how it is managed differs considerably and this has major implications for whether and how it is used. The cases are therefore good examples of how to improve something which all higher education institutions already do to some extent. Nonetheless, this does not minimize the innovative or restructuring potential of the cases. The successful usage of a Learning Analytics system requires far more than the introduction of a new technology. A solid, 'trustworthy' Learning Analytics or advice system means major restructuring at all levels of the university, implying that:

- Teachers need to allow others to intervene in 'their' course design;
- IT departments need to convince staff and institutional policy officials to cooperate in order to build a comprehensive data system;
- Student administrations need to make student data accessible, though with ethical and privacy safeguards.

The innovation objectives addressed within the second theme are context-specific; therefore contexts must necessarily be taken into account in addressing how innovations are to be successfully achieved. The recommendations set out below, therefore, relate primarily to the institutional level, although there are also some which need to be addressed at national or regional levels.

At the institutional level, the following measures are recommended for consideration:

- The identification of the (diverse) needs and circumstances of the learners;
- Ensuring learner access to relevant technologies and possession of necessary skills to gain maximum benefits from them;
- Recognise that the successful introduction of learning analytics will be dependent not only on the choice of technology but on making the institutional changes necessary so that teachers, IT staff and administrators work effectively together to support students;
- Provide appropriate processes, tools and support activities so that Faculty are able

to fully utilise the rich data generated through analytics to enable them to respond to individual student needs and to further develop their teaching;

- Clarification of the roles of the different actors (within and beyond the institution) involved in meeting these needs;
- Ensuring a collective understanding of the different roles/responsibilities and the relationships between them;
- Ensuring clear lines of management responsibility and information requirements to assess performance;
- Building supportive relationships and trust between the relevant actors (students, academic staff, support staff, IT staff, managers and, where applicable, employers).

At the national or regional level, the following measures are recommended for consideration in those cases where innovations are being sought at the system level:

- Clarification of the funding implications, intended outcomes and timescales for the innovation;
- The collection and analysis of feedback information (from learners, institutions, employers etc.) on performance and impact, and the use of the information to inform all relevant actors;
- The identification of any unintended consequences of the innovation (e.g. for other functions, for widening participation or labour market linkages).

5. Globalisation and internationalisation strategies

5.1 Overview

Increasing globalisation has encouraged the development of a 'global' system of higher education On the one hand, it is characterized by its diversity, not by its uniformity (Maringe and Foskett, 2010); on the other, there is a pressure of conformity and homogeneity caused by the effect of systems of global ranking that employ standardising criteria. Internationalisation is an effect of globalisation; when considering the concepts of globalisation and internationalisation as they exist in higher education, it is important to note that they are not synonymous or categorically definable, but are interlinked (Teichler, 2009). Many scholars have defined these concepts, and note that they require constant updating and redefining in international debates. Broadly, globalisation refers to a wider process of increased economic activities between nations, which necessitates greater homogenization of fundamental aspects of life across different countries and the erosion of borders (De Wit 2011). Internationalisation is an important strategic and organizational means of responding to and absorbing the effects of globalisation. In the higher education field, internationalisation should be understood as a process which introduces new dimensions to and improves institutional quality and delivery of education, rather than a specific, linear goal (De Wit, 2011). This aligns with the process-based, and widely accepted, definition of internationalisation proposed by Knight (1994, as found in Knight, 2008): 'the process of integrating an international dimension into the research, teaching and services function of higher education', subsequently updated to 'the process of integrating an international, intercultural or global dimension into the purpose, functions or delivery of post-secondary education' (Knight, 2008).

Internationalisation and globalisation have become increasingly important at the European level since the 1980s, when they have become an indicator for quality in higher education. An increase of policy interest has also intensified the debate about the quality of internationalisation itself. It is also noted that internationalisation is not a homogenous process across Europe: internationalisation strategies 'are filtered and contextualised by the specific internal context of the university, the type of university, and how they are embedded nationally' (De Wit, 2010). These strategies are dependent on the type of education and programs that individual higher education institutions provides and are further deeply rooted in 'the normative and cultural insights, such as history and culture; academic disciplines and subjects; the higher education institution's profiles and individual initiatives; the national policy environment; regulatory frameworks; finance; European challenges and opportunities; and globalisation' (Frolich and Veiga, 2005).

While in many contexts, internationalisation is seen mainly in terms of the international mobility of students, for both educational and business reasons, more broadly it also entails increasing concerns about the comparability of qualifications acquired within different national systems, the internationalisation of the curriculum, the links with an increasingly internationalised labour market and the concerns of many institutions and academics to reference themselves against the supposedly 'best' and 'world class' universities.

5.1.1 Challenges driving the pursuit of internationalisation strategies

There are several specific challenges for internationalisation that are closely linked with the competitive pressures that globalisation processes exert on higher education institutions. These include institutional gains, public service or commercial/business/financial gains. In a non-exhaustive list, institutional gains can be found in the feeling of enhanced stature and breadth that ensues from attracting more, and higher quality staff and students, and in enhancing the existing curriculum or the acquisition of knowledge and language. A contribution to public services can be felt through a sense of increasing public good across or beyond borders (Friesen, 2013), while commercial or financial gain can be promoted through the development of a commercial advantage, contributing to overall profits or responding to demand (Altbach and Knight, 2007). Alongside these, simple survival is also suggested to be a primary driver of internationalisation, not just the pursuit of excellence (Chen et al., 2013). ICT and other forms of technology are considered salient supporting tools, but not a specific driver of internationalisation (Thune and Welle-Strand, 2009). Regardless of which rationalization strategies are used to justify institutional activities, there will be overarching benefits to internationalisation plans, which can include the plan acting as mechanism for explaining the goal of internationalisation, a medium for interdisciplinary collaboration, or a tool for fund-raising (Childress, 2009).

As well as providing a set of commercial drivers for innovation, internationalisation brings with it a set of educational challenges. These include the need to review existing curricula, their relevance and accessibility to learners from a wide range of backgrounds and with a possibly contrasting set of expectations and goals. These may result in a need to provide new kinds of learning support services as well as reviewing and adapting existing forms of pedagogy. Where local and international students are mixed and interact, there are significant opportunities for enhanced learning and personal development by students through these engagements, though these can also be accompanied by misunderstandings and conflict. Overall, there is a challenge to decide how much to adapt 'home' educational provision to meet the more diverse needs and expectations of international students and what it is most important to retain as the 'distinctiveness' of the educational offer. There can be both market and reputational consequences from how such challenges are met.

5.1.2 Actors, roles, institutional processes

Actors actively involved with the internationalisation of higher education include several levels of **government** (regional, national and supranational organizations, such as the EU), as well as an increasing role played by international and overseas actors. At the European level, the Union has enshrined education and training into its fundamental policies. Other EU level policies, such as mobility and cooperation between Member States, also impact the progression of internationalisation (Crowther et al., 2000). National governments still hold the most decisive power over issues of education, where, for example, parliaments pass higher education laws which directly impact on the entitlement and award of international degrees. Some European countries even decentralize the issue of education further, and award regional councils with extensive responsibilities within the education sector. In addition, with regard to overseas campuses, existence in a host country means that new authorities and regulatory bodies are involved. Overseas campuses are faced with far more complex structures of actors, which have direct impact on the institution's autonomy and market accountability (Crowther et al., 2000).

For **higher education institutions**, internationalisation has both a 'business' dimension – bringing in additional revenues from international student fees – and an academic/reputational dimension – from positions in rankings and league tables and the mobility of leading scholars. The latter concerns the research function in particular, with its implications for an institution's standing in an increasingly stratified higher education world, both nationally and internationally. International recognition brings local as well as international rewards, and enrichment of the diversity and interests, as well as career prospects of academic staff. The former concerns more the education function, though is not restricted to it. It includes mobility of study abroad, either for the whole of a student's higher education experience or for part of it, for example through schemes such as ERASMUS. The latter indicate an educational value to international mobility per se, as well supporting an increasingly internationalised labour market.

The institutional approach to internationalisation may involve a deep shift of the mission underpinning strategic plans of the higher education institutions undertaking these initiatives or may be a more superficial, ill-thought through attempt to expand market, sometimes with unintended and negative consequences. Strategic plans for internationalisation can encompass a variety of activities; specific initiatives for internationalisation can include 'branch campuses, cross-border collaborative agreements, [or] programs for international students' (Altbach and Knight, 2007).

These types of activities implementing internationalisation strategies exist along another dimension as well; Crowther et al. (2000) suggest that the institutionalisation process can encompass both home-based and overseas-based activities. Internationalisation 'at home' covers 'any internationally related activity with the exception of outbound students and staff mobility' (Crowther et al., 2000:6), as well as efforts to adapt curricula, teaching and learning. These efforts aim to help students develop intercultural skills and awareness. Internationalisation abroad focuses more on the development and provision of international education in a foreign country or cross-border education (Knight, 2008). In order to ensure an adequate response to globalisation, higher education institutions create internationalisation plans which delineate their strategic and organizational ambitions. Higher education institutions can rationalize their internationalisation strategies along the following axes: political (foreign policy, mutual understanding, national and regional identity etc.), economic (growth and competitiveness, labour markets, financial incentives etc.), social and cultural (role of the institution, participation and development of the individual within the changing landscape) and academic (development of international dimensions in research, institution building, prestige and status etc.) (De Wit, 2010).

Faculty members are key drivers and actors in the institutional process of internationalisation (Friesen, 2013). Faculty itself can be motivated by various issues such as intercultural experiences and intellectual expansion. Internationalisation strategies should not fail to recognise faculties, and should extend to including them in plans. Barriers to faculty participation include: lack of coordination and available information, constraints due to limited funding, disincentives to participation in international initiatives, lack of staff to facilitate the process (Dewey and Duff, 2009).

Students are important drivers of internationalisation; motives for studying abroad are varied, as are the outcomes. For students, there are the usual differences according to social and educational backgrounds as well as national differences. A recent study by Brooks and Waters (2011) reported that students who seek to study abroad are typically students who have failed to get places at their 'top' national universities and who decide to go overseas rather than go 'down-market' in their home higher education system. Thus, they may be looking essentially for status rather than education in their decision to study abroad. Universities have amplified their internationalisation strategies in response to globalising and increasing demand. Stromquist (2007) identifies universities' interest in student recruitment as a driving force in their internationalisation strategies, but notes that 'students from poorer regions such as those from Africa and many Latin American countries are not recruited' and universities have not adapted their curricula to global needs (Stromquist, 2007). Universities essentially offer the same courses they do to national students to international students, and may explicitly look for students with a command high enough to do so; though there is an increased interest in international students, universities have made limited steps in changing the educational experience for international students and creating truly international or global education. However, it can also be argued that internationalisation is not only 'study abroad'. Even for home-based students, there are challenges of preparation for lives to be lived in increasingly internationalised societies and economies.

5.1.3 Open questions for the future of internationalisation strategies

Internationalisation strategies pursued by higher education institutions are still confronted with a variety of issues, including the 'recognition of foreign diplomas and degrees, [and…] the recognition of credits and study periods abroad' (Van Damme, 2001), which suggests the need to develop and regulate quality control.

5.2 Findings from the case study related to globalisation and internationalisation strategies

One case study addresses this theme: the University of Nottingham, which has established campuses in Malaysia and China as part of a larger entrepreneurial transformation strategy for the whole university.

A short summary of the case study[20] is highlighted below, while the remainder of the chapter sheds light on the main issues raised by this case study.

> **The internationalisation strategy of the University of Nottingham (UK) and the establishment of campuses in Asia:** this case study analyses the internationalisation strategy of the University of Nottingham which started with plans to set up two international campuses in Malaysia and China, originating in the 1990s. This innovation is seen as part of deeper and wider institutional processes: the initiatives aimed not only to make Nottingham a global university, but to transform its identity, mission and ways of working from deeply conservative to vibrant, visionary and imaginative .The initiative is seen as 'deliberatively disruptive'. The overall objective of establishing the two Asian campuses, in Semenyih, Malaysia in 2000, and Ningbo, China in 2004, was to

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[20] Full case study monographs are available in Annex to the report

create a different identity and stature for the university than could be won in the UK alone; to progressively embed an attitude of innovation and an international outlook throughout the university.

5.2.1 Why was the innovative practice put in place? An overview of challenges

This case study is a clear illustration of an institutional response to the challenge of globalisation. The initiative can be read as the attempt of the university to reap the potential benefits (e.g. enter new 'markets') and avoid potential threats (e.g. increasing competitive pressures at international level) posed by the globalisation process. This resulted in the strategy to think and develop globally rather than predominantly nationally and become a leading higher education player by internationalising. The strategy was materialised in the establishment of two Asian campuses, which allowed the university to position itself as a sector leader at a time when the whole UK higher education sector was looking for new business opportunities abroad. Going global opened up opportunities for competitive advantage and a new sense of identity and purpose less easily available in the constraining UK context. There was, thus, a mixture of commercial, reputational and educational challenges to be met by the form of internationalisation strategy being attempted here.

5.2.2 Impact of the globalisation and internationalisation practice on the higher education innovation system functions, components and relationships between components

Impact on the higher education innovation system functions

This practice was initially related to the education function of the university, which entailed retaining a campus-based teaching-learning approach called 'the Nottingham experience' and replicating it overseas, with considerable efforts in local staff recruitment and learning. The initiative soon impacted on the two other functions as well: the new campuses contributed to raising the university research profile (e.g. Marine Economy research at the Ningbo campus) and to a broader engagement with local stakeholders in Nottingham and in Asia, in a form of 'third mission' that was strictly linked with the teaching and learning experience. The 'third mission' element of the initiative is evident in the local business partnerships underpinning the development of both two overseas campuses and reflected in the choice of courses and curricula to be offered. It is also manifested in the increasingly deep and multi-faceted engagement with Nottingham City and the immediate wider region, especially in the Ningbo China development by joint overseas missions, as well as in the local socio-economic environment, as testified by the Editor of the local newspaper in Nottingham who has had a close experience of this evolution over twenty years.

Impact on higher education innovation system components

In terms of impact of the practice on the higher education system components, the initiative highlights the importance of a sustained top-down effort over a significant period of time by a powerful institutional leader who built up a strong team of management support to carry the initiative forward. Thus, an individual actor within the institution can be seen as the initiator of the internationalisation strategy. Externally, it received support from governments and private

enterprises in all three of the national (and regional) contexts of the multi-national university. Staff and students were also important actors.

Impact on the relationships between higher education innovation system components

As an initiative which was intended to transform an entire university, the internationalisation strategy had increasing emphasis on people mobility and transfer. There are some indications that there has been change at the main Nottingham campus in the UK, and hence in the experiences of its students and staff located there. Change was not immediate, and there is mention of early opposition and indifference to the concept of 'export' of the Nottingham model to Asia, which had to be overcome. It was however clearly indicated that the institution's international profile has been a magnet for attracting high quality academic staff, and a shift from complacency to innovativeness in staff working practices took place. It was also indicated that the benefits of a change of profile and even identity were significantly shared by the City of Nottingham and the surrounding regional community, strengthening the city/region's capacity as a competitive regional economy as well as the university-city partnership.

5.2.3 Impact of contextual factors on the innovative practice

As with most innovative practices in higher education, one of the factors for success is that the innovation is embedded in the institutions' strategy. In the case of internationalisation, this is no different, the University of Nottingham maintains a long-term strategy in which internationalisation is strongly embedded. Besides this strategic orientation, two contextual factors played a key role in the realising the internationalisation strategy and implementing this innovative practice. First, the autonomy granted to public universities in the UK was an essential precondition for this sort of institutional vision, effectively comprising a single university – 'public' in one of its national contexts and 'private' in the other two. Secondly, the high reputation of the university, as well as of the various quality assurance bodies in the UK also played a determining role in the successful achievement of the internationalisation strategy and the navigation of foreign regulatory regimes.

5.2.4 Outcomes and blockages of the innovative practice

The concrete outcomes are two new international campuses that have established and have growing student populations – currently 4,500 in Malaysia and 5,500 in China, with realistic targets for growth that are steady rather than dramatic in coming years. The curriculum at the two new campuses has been evolving beyond the initial largely vocational emphasis and there is a clear intention to connect it with regional economic and other needs. There is also a clear intention to develop research and knowledge transfer functions, and several initiatives have already occurred, with new research centres created. There is also a new Doctoral Innovation Centre at the China campus with 100 PhD students dividing their time between China and the UK for their research on energy and digital enterprises.

Many of the potential blockages to the initiative were circumvented by the sustained leadership that the initiative enjoyed. These include the initial internal conservative resistance, as well as 'parochial' resistance and suspicion of motives in Malaysia and China, where high-level patronage was used successfully. Another potential blockage, i.e. that resulting from juggling relationships with three different governments in different political contexts, was avoided

through sensitivity to local norms and practices. The Vice-Chancellor had a genuine interest in the history, culture and ways of the partner countries and became well versed in these before and while doing business. Thus, the only evident bottleneck was in the scale and cost of very senior management time needed for the thorough hands-on approach adopted. This was resolved by staying with just two campuses, and using other means for internationalising in other places and ways. The staffing and management of an international campus has presented particular challenges. IT limitations became evident with much enlarged scale and are being addressed in view of future developments in coming years.

5.3 Concluding remarks on globalisation and internationalisation strategies

From a narrower point of view, it could be argued that this theme is relevant to only a small proportion of higher education institutions – those possessing or aspiring to possess a global reach and brand. From a broader point of view, however, it can also be argued that the theme is relevant to a much larger proportion of higher education institutions, as globalisation is a general feature of the modern world and has implications for all higher education institutions. Below we make some general recommendations concerning innovations stimulated by globalisation and internationalisation in general, and then consider the particular case of multi-campus universities.

For innovations related to globalisation generally, the following measures are recommended for consideration by higher education institutions:

- Balancing between commercial, educational and reputational considerations in formulating their overall international strategy;
- Addressing a range of interconnected factors such as student mobility (inward and outward), student placements, qualification recognition, funding implications, curriculum and pedagogic implications, and labour market linkages;
- Considering the needs of different actors including home and international students, academic and support staff, quality assurance agencies, employers and sponsoring bodies.

In addition, where multi-campus innovations are involved, there is a need to consider a further set of measures:

- Engaging 'home' staff and to build relationships between staff located at the different campuses;
- How much to 'export' from the home institution and how much to build to reflect local contextual factors at different campuses;
- How much to 'import' from the international activities to reshape the home institution;
- How to satisfy different national regulatory and quality assurance regimes.

Policy-makers should in turn consider:
- Providing support for inward and outward mobility of students.

6. Conclusions

The main findings are structured around the four overarching questions of the study.

> - What are the main challenges facing higher education and driving innovation in this sector?
> - What are the key differences in terms of regional and institutional contexts for achieving successful innovation in higher education for different constituencies?
> - How does innovation in higher education involve key system components and how does it influence – directly and indirectly – the system functions? What are the key processes and the roles of the key stakeholders in implementing innovation?
> - What are the major outcomes of innovation in higher education and what bottlenecks and blockages exist in achieving them?

The findings draw on relevant literature on innovation in higher education and on the seven case studies. They need to be considered in the light of the fast-moving nature of the field, the time that innovation and change need to become embedded in institutions and systems, and the difficulty of predicting long-term outcomes of major innovations.

6.1. Main challenges driving innovation in the higher education sector

A review of literature on innovation in higher education revealed three main challenges facing higher education[21] across the globe and also driving innovation in the sector:
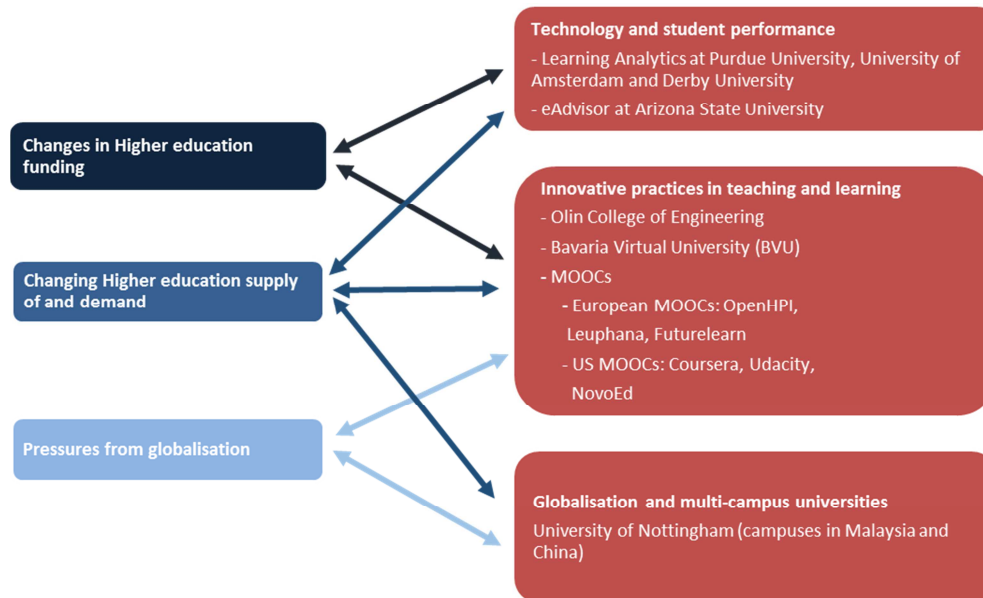
- Pressures from globalisation;
- Changing supply of and demand for higher education;
- Changes in higher education funding.

In response to the external challenges, various innovative practices in delivering the education function of higher education institutions have been developed around the world, some of which have been captured by the seven case studies conducted within our research. They have been grouped in three themes that reflect their various natures and that present several areas of overlap and interconnection:

- The changing landscape of teaching and learning in higher education;
- Technology and the student performance in higher education;
- Globalisation and multi-campus universities.

As the figure below illustrates, the same challenge may trigger different institutional responses, manifested by the introduction of different innovative practices at different higher education institutions. Conversely, the same innovative practice may be simultaneously driven by more than one challenge or respond to more than one challenge.

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[21] It is not claimed that these are the only challenges facing higher education or that these challenges are exclusive to higher education. But they do constitute major challenges for higher education generated by a changing external environment. In turn, these create internal challenges for higher education institutions to change and adapt in order to meet the changing external requirements.

Figure 1: Challenges and innovative practices adopted to address them

Changes in Higher education funding

Changing Higher education supply of and demand

Pressures from globalisation

Technology and student performance
- Learning Analytics at Purdue University, University of Amsterdam and Derby University
- eAdvisor at Arizona State University

Innovative practices in teaching and learning
- Olin College of Engineering
- Bavaria Virtual University (BVU)
- MOOCs
   - European MOOCs: OpenHPI, Leuphana, Futurelearn
   - US MOOCs: Coursera, Udacity, NovoEd

Globalisation and multi-campus universities
University of Nottingham (campuses in Malaysia and China)

Challenges from globalisation

Globalisation challenges are manifested on multiple planes. Politically and economically, there is an increasingly complex interplay of local, national and global factors that need to be carefully balanced, and a fierce international competition for markets, resources, technology and knowledge. In the higher education sector, there is a growing international mobility of labour and students, emergence of new institutional formats responding to new criteria of excellence and competitiveness, an increasing alignment of national policies, especially in such areas as quality assurance, qualifications and links to the labour market, to the global trends, as well as a strong competition to recruit international students and achieve global recognition for courses and qualifications in order to meet the labour market needs of all students. Many higher education institutions increase cross-border operations and seek to take best advantage of the new opportunities provided by the use of technology as a 'disruptive enabler'. Moreover, an increasing level of boundary crossing, within and beyond higher education institutions, as well as between higher education institutions and business providers of education, can be observed. This may be even more 'disruptive' than any new technologies, as new relationships are being formed, expectations and roles change, lines of authority can be radically altered and established practices may eventually be replaced by new ones. New private providers of higher education and new knowledge-intensive enterprises are entering territories previously dominated by mainly state-supported universities. This 'opening up' of knowledge societies poses both threats and opportunities for higher education. What is clear is that different higher education institutions respond to the challenges of globalisation in different ways, partly reflecting their different contexts and partly reflecting their different institutional aspirations and perceived opportunities.

Many of these features can be seen in our case studies. For example, the University of Nottingham has adopted an institution-wide internationalisation strategy aimed to transform it

into a global university and strengthen its potential in the competition over foreign students. To realise this goal, two campuses in Asia (Malaysia and China) have been established, and their implementation has been considered to have successfully integrated national and international agendas, student and staff mobility, as well as educational, reputational and commercial institutional interests.

If some universities, like Nottingham, have adopted internationalisation and going overseas as a 'go out to the students' strategy, others have positioned themselves on the opposite trend of 'bringing the students in', by attracting students, regardless of their physical location, through e-learning as well as more traditional mechanisms of recruiting international students. The MOOCs are a clear example of this trend, with a rapid development in US, Europe and elsewhere. Coursera's vision of giving the possibility to 'anyone around the world', to 'learn without limits', accurately describes one of the most important missions of MOOC providers. The massive sign up figures provide evidence of the success of MOOCs in responding to previously unmet demand for higher education, although further work is required to understand the significance of the low completion rates. Overall, it is too early to judge what impact MOOCs will have on the rest of higher education.

Challenges from the changing supply of and demand for higher education

Today's supply-side developments in higher education frequently revolve around the use of technology as a means to improve students' performance and learning experience through new online teaching and learning methods and learning environments that developed alongside traditional ones and, in some instances, have started to replace them. The MOOCs and Learning Analytics case studies illustrate the changing landscape in the supply side of higher education from various angles, with different tools and approaches (e.g. implementation of Course Signals at Purdue University to increase student success in the classroom, introduction of the eAdvisor at Arizona State University to facilitate students' choice of a major and successful graduation, and development of different MOOC platforms by a range of providers, with different philosophies).The provision of 'blended learning' opportunities through the introduction of on-line alongside more traditional face-to-face teaching and learning is another developing practice, witnessed in the case studies by the Bavarian example.

On the demand side, changing needs of, and expectations from students and employers, as well as changing patterns of skills acquisition and lifelong learning, prompt higher education institutions to innovate. The case of the Olin College of Engineering shows how new ways of teaching and learning that move away from the traditional role of students as 'recipients' of knowledge into pro-active contributors to curriculum design and the learning process appear to have been beneficial in meeting employers' needs in a specific field – engineering – where graduates' lack of central skills was a recurrent problem. Similarly, the development of MOOCs is also an example of providing lifelong learning and home-based learning, driven by an ever increasing demand in this respect from both employees and employers. Therefore, different models of learning – active or passive, collaborative or individual – may be features of these different types of innovation.

Challenges from changes in higher education funding

Increasing education costs and declining funding, especially from public sources, have been key features for higher education in recent decades. They are at the centre of heated debates

over the differentiated impact across institutions and disciplines, over beneficiaries of and contributors to higher education, over student attraction strategies and finding new ways of cutting costs or generating additional revenue, or both. Uncertainties and an increasing multiplicity of funding sources exacerbate the challenges for institutions.

Learning Analytics and the eAdvisor initiative at Arizona State University show how traditional functions of higher education institutions (e.g. mentoring and advising students) may be implemented differently and more cost-effectively through the use of technology. The MOOCs case studies show how e-learning is also impacted by changes in higher education funding, with the declared objective of several MOOC initiatives to provide low or no- cost education to large numbers of students. The implications for more traditional forms of higher education are still unclear at present.

> **Conclusion:**
> Three challenges emerge as particularly relevant in driving innovation in the higher education sector: (i) challenges from globalisation; (ii) challenges from the changing supply of and demand for higher education; and (iii) challenges from changes in higher education funding. These challenges are linked to deep changes not only at local, national and global levels, but also at the level of institutional organization, management, funding, interaction with business, government and other partners, education provision, content and delivery methods. These various challenges determine the development and implementation of various innovative practices to address them.

6.2. National / regional and institutional contexts for innovation

The contexts of the innovative practice differ in all the case studies and determine in what way the innovation is shaped and what the scope of the practice is. A distinction was made in the analysis between national/regional contexts and institutional contexts, which are seen in a close interplay:

- **The national/regional context includes factors applicable to all (or most) higher education institutions in a specific region or country.** Factors include the autonomy and decision-making powers of higher education institutions in a country or a region, funding sources, channels and amounts (e.g. the balance between public and private funding or between national and international funding sources, institutional vs. competitive funding, etc.), or the general higher education traditions in the country. Different parts of the world have different institutional traditions in terms of matters such as the power of the professor (the so-called 'professor's privileges'), mobility of students and staff, student learning and assessment, transmission of knowledge. All these factors may determine the success of an innovative practice, as they affect the entire life cycle of an innovative practice, from the starting point to its final stages;
- **The institutional context includes factors that influence the way a higher education institution is organised and functions.** Factors include the higher education institution's overall mission and the balance between its education, research and engagement missions, the scope of its commercial partnerships and orientation, its student population, staff, relationship with the regional labour market, etc. All these institutional factors affect the way innovative practices are to be achieved, as well as what innovative practices are needed and achievable in particular contexts. Institutional context factors are

equally important in achieving successful innovation practices as the broader national/regional contextual factors. Furthermore, institutional factors such as background and tradition, histories and strongly embedded organisational cultures also influence the balance and relationship between the education and the other university functions.

The most prominent contextual factors for success of the innovative practices examined in our case studies vary significantly, as illustrated in Table 6.

Table 6: summary of most prominent institutional and national/regional contextual factors by case study

Case study	Contextual factors
Olin College of Engineering (US)	**National/regional factors**: The recommendations of the National Science Foundation emerging from their study on the state of the art of engineering education in the US, provided a roadmap for the development of Olin College's innovative curriculum. **Institutional factors**: The individual initiative of FW Olin Foundation Director, who was keen to initiate a college that could address some of the major problems of engineering education in the US (i.e. not enough relevance of education to the labour market, not enough emphasis placed on problem-solving, too much theory over practice, and research over teaching). This individual dimension was coupled at the Foundation's institutional level with the financial contribution from the Foundation that allowed the Olin College to open.
Bavaria Virtual University (Germany)	**National/regional factors**: The Bavaria state funding given to all partner institutions (Freistaat Bayern); the political stability of the state of Bavaria, enabling a large project such as the BVU to mature. **Institutional factors**: The status of BVU as a state-funded, but state-independent, university-governed permanent organisation, which receives permanent funding from the state and does not depend on *una tantum* project-funding.
US-originated MOOCs	**National/regional factors**: The collaboration with the American Council on Education's College Credit Recommendation Service (ACE CREDIT) of both Coursera and Udacity for the evaluation and accreditation of a selection of their courses, the support of notable Silicon Valley venture capital firms that was essential for the set-up and growth of all three MOOC platform providers, a specific legal context for granting credit to MOOCs that is starting to take shape in California, Florida and other states. **Institutional factors**: Stanford University's strong

	institutional tradition for online learning that can be traced back to 1969, the close interaction between the university and the platform providers, the intellectual property rights agreements made between the higher education institution and the MOOC platform providers regarding course and material ownership, the common wish of all three platform providers to deliver high quality education, free or at low cost, to large numbers of students from all over the world, although their individual approaches to realising this objective varies from one case to another.
EU- originated MOOCs	**National factors**: The support of the UK government to FutureLearn, exemplified by its promotion of FutureLearn at the G8 summit. **Institutional factors**: Institutional tradition for online learning. This was identified as the largest motivation for the Open University to embark in the MOOC adventure and play a major role within FutureLearn. Similarly, Leuphana piggybacked its initiative on the Digital School that was already existing, also therefore embedding the development of the MOOCs into its own institutional tradition, albeit less long-standing than at Stanford or the Open University. Open Hasso-Plattner Institute developed its programme thanks to its institutional autonomy, granted by its status as public-private partnership. The collaboration between mainly state-funded institutions (FutureLearn) is also noteworthy here as an institutional factors for success
Learning Analytics at Purdue University (US), the University of Derby (UK), and the University of Amsterdam (the Netherlands)	**National factors:** No major contextual factors at national / regional level were identified. **Institutional factors:** Initiatives linked to the presence of 'early adopters' among the faculty who have an interest in the development of such initiative and that manage to embed it into the institution, strong role of the university internal institutional structures and willingness to enhance student performance, in the context of a move towards a student-centred vision of higher education.
The eAdvisor at Arizona State University (US)	**National/regional factors**: National effort to regain the world lead by increasing American degree attainment to 60% by 2020, introduced after President Obama's 2009 pledge; Arizona State University's affiliation to the 'Next Generation Universities' ('Next Gen U') that have embarked on the endeavour to introduce new innovative, cost-effective approaches to teaching and learning, especially using new ITs; Private funding of $1 million from the Kresge Foundation for the development of the e-Advisor transfer partnership component (which allows the transfer to Arizona State University of students from other higher education

	institutions, in particular the state community colleges), and another $1 million from another private investor for the development of the high school partnership component. **Institutional factors**: Arizona State University's innovative environment and student-centred education vision, the dedication of the institutional team in charge with the development and implementation of the e-Advisor, Arizona State University's status as the country's largest public university (74,000 students), and also Phoenix's only public university, with a very diverse student body, which makes it accountable to the tax payer and striving to achieve the best results for the funding it receives. Arizona State University's strong awareness of the social and economic impact of college graduates.
Internationalisation strategy of the University of Nottingham (UK) and the establishment of campuses in Asia	**National factors:** The high reputation of various quality assurance bodies in the UK and the autonomy granted to public universities in the UK were essential precondition for the internationalisation vision. **Institutional factors**: The high reputation of the university, strategic embedding of internationalisation and dedication of the management to implement the strategy.

The table above illustrates how the interplay between national/regional and institutional factors contributes to the development of the innovative practice examined in each case study and the further implementation/scaling of the practice. The prominence of one or another type of factors varies subject to various features. One such feature appears to be the scope of the innovative practice: the broader the scope, the higher the influence of national/regional factors; the more limited the scope, the higher the influence of institutional factors. Another feature is the autonomy of an institution and the balance between its bottom-up and top-down approaches to innovation. In general, more autonomous higher education institutions, having more control over their financial resources and allocation of these resources to their functions, tend to develop more bottom-up practices. The direct impact of these types of innovations may be more immediate, but also more limited, often confined to the boundaries of the innovating institution. On the other hand, less autonomous higher education institutions tend to have a more top-down, state-driven approach to innovation. This does not make them less innovative, but comes to support wider-ranging relationships and processes across the higher education system and longer timescales for implementation, ensuring a longer-term and larger impact beyond institutional boundaries.

The development of the Learning Analytics Course Signals system at Purdue University, the eAdvisor at Arizona State University and the internationalisation strategy of the University of Nottingham have in common a context where these institutions have a high level of autonomy and the innovation impact is limited to the particular institution. State-driven innovation is exemplified by the Bavarian Virtual University (Germany), where more than 30 state-funded universities cooperate to develop online-courses provided across the institutions' borders. The

innovation is clearly a top-down initiative steered by state funds and the innovation impacts on the entire higher education system in the State of Bavaria.

> **Conclusion:**
> Successful innovative practices build on an interplay between national/regional and institutional factors that varies subject to the scope of the innovative practice, and the higher education institution's balance between bottom-up and top-down approaches to innovation.

6.3. The impact of innovation on the higher education system elements

The development and implementation of innovations in a higher education system have an impact on all the system elements: components, relationships and functions.

At the level of *components*, all the innovative practices discussed in this study appeared to have a broad impact, reaching out to the entire typology of actors identified in the analytical framework of the study, i.e. direct individual actors (e.g. students, academics, and university administrators) and direct institutional actors (e.g. faculties and departments), as well as indirect actors (e.g. regional and national governments, companies, funders, entrepreneurs). A general effect on these different stakeholders was a broader perspective and range of activities that go beyond institutional boundaries and bring about not only technological innovation, but also organisational and management innovations. In all the innovative practices discussed, 'innovation champions', strong management teams and some external organisations, involved especially in funding, proved to play a key role in bringing about and accelerating qualitative improvements.

At the level of *relationships*, there is clear evidence that when innovative practices are introduced, traditional relationships among actors – individual or institutional – are changed and sometimes even replaced by new ones. At the individual level, all the innovative practices examined intensified the cooperation between the actors, notably academics and students. In the case of Olin College of Engineering, as part of the rationale for an innovative project-based learning approach, students and academics worked together to design the curriculum, an approach which challenges the traditional relationships between student and teacher. The Learning Analytics cases show significant changes in the traditional relationship between student and teacher or mentor, coming from the introduction of technological tools and virtual environments, but also changes in the course design, faculty autonomy and in the roles of the IT staff, who became more sensitive to the way the communication with students takes place. The MOOCs introduced a new role for students in peer assessment. The internationalisation strategy of the University of Nottingham increased mobility and transfer among students and staff particularly at the main Nottingham campus in the UK, attracted high quality academic staff and increased innovativeness in staff working practices. These benefits were shared by the City of Nottingham and the surrounding regional community, strengthening the competitive edge of the city/region economy, as well as the university-city partnership.

At the institutional level, an intensified cooperation and networking among direct and indirect actors, either financially- or non-financially driven, was observed. For example, the US MOOCs and the eAdvisor cases reflect cooperation between higher education institutions and private capital to develop and implement the platforms. BVU is an example of institutional cooperation mandated by the government; the US MOOCs and one of the EU MOOCs (i.e. FutureLearn)

have networked institutions or partnerships among institutions as key features; Olin College of Engineering cooperates with institutions specialising in different academic fields to provide a comprehensive education to students and aims at 'exporting' its teaching and learning model to other institutions. Increasing cooperation appears thus a mechanism that is adopted to pool existing resources and acquire new ones, share the risk and also some of the costs incurred by the implementation of innovative teaching and learning practices. Increasing cooperation does not contradict the increasing competition that we also noticed among higher education institutions, but the two aspects coexist and manifest themselves as distinct individual and institutional responses at different levels and in different geographic or socio-economic contexts.

Innovative practices changed not only relationships between individuals and between institutions, but also between individuals and institutions. This was visible in some forms of conflict between the new and old forms of teaching, learning, university-faculty relationships, university-external technology providers, intellectual property rights, etc. The rise of 'star professors' highlighted by the US MOOCs is a particularly relevant example in this sense, due to its potential to generate significant changes in the configurations of power and privileges in academic hierarchies.

At the level of *system functions*, the innovations examined in this study had the most visible impact on the education function, which was examined from different angles, as this was the main objective of the study. For example, Learning Analytics addresses deficiencies in teaching and in student-teacher interaction, which often result in a lack of engagement with learning. In more advanced systems (e.g. Purdue), Learning Analytics also addresses course structure and quality, encouraging faculty to improve these aspects by providing systematic feedback from students. This makes Learning Analytics an interesting pedagogical tool. The eAdvisor focuses on other aspects of the education function: advising students on their learning trajectories and choices, offering opportunities for course development based on student feedback on various courses; and facilitating student mobility through a number of specific functions. The internationalisation strategy of the University of Nottingham was initially related to the education function of the university, through the campus-based teaching-learning approach called 'the Nottingham experience', which was replicated overseas, with considerable efforts in local staff recruitment and learning.

Furthermore, all the innovative practices examined have the potential to spill over to the other higher education system functions, i.e. research and engagement. The impact on these functions could also be scrutinized, due to the innovation system approach adopted in the study. For example, online learning environments proved to serve as a test bed for research on the behaviour of online learners, as shown by the US MOOCs, OpenHPI and Leuphana. Further, the establishment of online learning environments often require cooperation with entities outside the higher education sector strictly speaking, thus contributing to blurring the university boundaries and encouraging the development of 'third mission' activities. 'The Nottingham experience' initiative also impacted on the research and engagement functions: the new campuses contributed to raising the university's research profile and to a broader engagement with local stakeholders in Nottingham and in Asia. This contributed to a 'third mission' that was strictly linked with the teaching and learning experience, and was reflected in the choice of courses and curricula to be offered. These new partnerships are also manifested in the complex engagement with Nottingham City and the immediate wider region, especially

in the Ningbo China development by joint overseas missions, as well as in the local socio-economic environment.

From the analysis of innovation in higher education form an innovation system perspective, three dynamics of particular relevance emerge:

- First, **as innovation diffuses within the higher education system and touches every element of a higher education institution, the transition to an innovative system needs to be better managed.** Many universities have strong business schools that teach these methodologies, but university management is not trained for this: in most cases university managers are promoted academics;
- Secondly, all these aspects underline **a reciprocal nature of change within an innovative higher education system: the system elements (components, relationships and functions) have an impact on the success of the innovation, while success of the innovation induces further changes in the system elements.** A spiral of change is thus created, an 'endless transition' (Etzkowitz and Leydesdorff, 1998) that ensures both renewal and a 'creative destruction' (Schumpeter, 1942) within the higher education system to make it more responsive to changes in the environment;
- Thirdly, **the change induced in a higher education innovation system by the innovative practices examined in the study is not of a radical nature, but rather slow and incremental.** Many innovation practices do not radically modify the traditional higher education institutions' functions; rather, they tend to provide new ways of doing traditional things, all underpinning a constant process of renewal that accommodates practices that respond more efficiently to changing requirements in higher education. For example, the emergence of Learning Analytics and similar initiatives, like the eAdvisor provide new ways of implementing universities' traditional functions (e.g. advising and mentoring students) making use of latest technological developments to achieve old objectives in new, more efficient ways. The concept of macro-level blended learning, e.g. as illustrated by the BVU case study, is an example of implementing a traditional function (course design and delivery) in new ways (e.g. mix of online and face-to-face learning at programme level).

Conclusion:
The development and implementation of innovations in higher education systems have an impact on all the systems elements: components, relationships and functions. At the components level, a wide range of direct and indirect, individual and institutional actors are influenced by these innovations. At the relationships level, the most important effects are due to cooperation, networking and increased mobility, which alter traditional relationships among actors or introduce new ones. At the functions level, the most significant impact is observed on the education function, and a more limited, but growing impact is observed on the research and engagement functions. This may be seen just as a manifestation of the early stage at which many of the innovative practices examined find themselves, rather than an effect of a minor importance of the innovation. Therefore, the impact of some innovation practices on other system functions, such as research and engagement, is likely to intensify and become more visible over time, as the innovation matures and diffuses more broadly into the higher education innovation system. Three dynamics appear to be most significant within an

innovative higher education system:

- As innovation diffuses within the higher education system and touches every element of a higher education institution, the innovation process needs to be better managed;
- There is a reciprocal nature of change within an innovative higher education system: the system elements (components, relationships and functions) have an impact on the success of the innovation, while success of the innovation induces further changes in the system elements;
- The change induced in a higher education innovation system by the innovative practices examined in the study is not of a radical nature, but rather slow and incremental.

6.4. Outcomes and blockages

Four major *outcomes* emerge from the study:

1) **New technologies are important enablers of innovative practices in higher education.** They are often applied to teaching and learning support processes in higher education. Large numbers of students have already experienced new forms of teaching and learning resulting from these innovation initiatives, as the MOOCs, Learning Analytics, and eAdvisor suggest. But these developments do need to be subject to critical analysis. It has been noted already; issues around dropout and student progression in MOOCs and questions relating to quality assurance and accreditation have been raised. It is essential that with developments such as MOOCs, researchers and stakeholders look beyond the headline number count and continue with detailed investigations in order to help better answer the question as to the extent to which MOOCs are offering a rich learning experience for their students.

2) **New technologies support a major shift in higher education that is now increasingly salient around the world, i.e. the transition towards a more student-centred vision of education.** This transition can take different forms: it may include developing new courses and course designs aimed to improve students' learning experience (such as the MOOCs, BVU, and Olin College of Engineering case studies suggest) or it may seek to improve students' feedback and information services and to give them greater choice over their studies (as the Learning Analytics and the eAdvisor case studies suggest). It is recognised that while technologies are supporting this shift, faculty require support, time and resources, so that good learning design and imaginative pedagogical approaches are deployed in order to make an engaging and interactive online environment for students.

3) **Innovation in higher education stimulates the development of partnerships between higher education institutions and other organisations, especially businesses.** As exemplified by the MOOCs, BVU, and Nottingham case studies, the pursuit of innovative practices is often accompanied by the development of new partnerships between higher education institutions and other stakeholders, notably businesses.

4) **Innovations in higher education illustrate well two general key aspects of the innovation process: 'doing new things' and 'doing existing things better',** in various extents that depend on the balance between institutional and national/regional context

factors. Innovations that aim to 'do new things'[22], of which the MOOCs are probably the major example, have the potential to substantially extend the available educational and learning opportunities. They involve new kinds of relationships and provide a greater flexibility in taking the knowledge base of higher education to new parts of society. What society will do with this extended knowledge base cannot be predicted at this stage, but there are potential economic and social impacts from making knowledge more widely and flexibly accessible. There is an emerging model of higher education being primarily a part-time activity over much of the life course rather than a full-time activity for a few years following the compulsory stages of education. On the other hand, examples of innovations 'doing existing things better' included the processing of existing data about students, courses and institutions to inform better decision-making by stakeholders and also by students. In increasingly differentiated higher education systems which provide students with many options of what, where and how to study, innovations which provide better information to inform the many choices which students have to make are clearly desirable.

The *blockages* for innovation can be found both at the institutional level, such as resistance to change and lack of institutional support, and at the national/regional level, such as lack of autonomy of higher education institutions. Gaining institutional support for innovative practices can be sometimes difficult in the case of bottom-up approaches, where a small group of believers has to convince other institutional players to support the innovation. Getting extended support at all levels (from within one's unit to national/regional support) is one of the most persistent bottlenecks for innovation, as it impacts the cooperation within higher education institutions and the cooperation between higher education institutions and other stakeholders. This is explicitly mentioned in the Nottingham, MOOCs and BVU cases. The regulatory framework is also a crucial potential blockage to many innovative practices that needs to be taken into account, for instance those including the use of technology (e.g. the issue of quality and credit recognition in the MOOCs; or the ethical codes to the use of data in Learning Analytics) and those entailing internationalisation strategies (e.g. navigating foreign regulatory regimes).

> **Conclusion:**
> Although blockages for innovation in higher education may occur both at the institutional and the national/regional levels, innovative practices do show the potential for delivering high-quality and equitable outcomes, in terms of widening access to higher education, granting students a more central role within the system, and providing potential pathways to cope with the financial pressures that affect the system.

6.5 Policy recommendations

Today, we are living in 'knowledge societies' and higher education institutions not only have a central role in such societies, but their role is also evolving rapidly. In order to adapt to changing circumstances, meet new challenges, and contribute substantially to the societies of which they are an important part, higher education institutions are required to innovate at a pace and on a scale not previously experienced in their long histories. Based on the main dimensions and findings of our study outlined above, we provide in tabular form a set of

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[22] Although as recent developments at the US MOOC provider Udacity illustrate, with the introduction of tutors and fee payments, the distinction between "doing new things" and doing "existing things better" may be a flexible one.

recommendations structured along two dimensions: (i) the target audience of the recommendations, namely higher education institutions and policy-makers; and (ii) the theme that the recommendations refer to, namely innovations in teaching and learning, the use of technology to improve student performance and globalisation and multi-campus universities.

Table 7: Policy recommendations and points for consideration by theme and target group

Theme	Innovation in teaching and learning
Target group	**Higher education institutions**
	- Nurture an institutional culture to innovation that enhances creativity, creates awareness of the benefits resulting from the implementation of the innovation, stimulates openness to innovation and minimises resistance to change; - Consider incentives and rewards for members of staff (including but not limited to academics) who engage in innovative practices; - Engage faculty members in exploiting the potential of new teaching and learning technologies; - Consider the use of cross-institutional collaboration to improve student choice and quality (and possibly cut costs); - Put in place adequate measures for skills development of teaching staff and also for greater collaboration in performing their teaching duties; - Review existing organisational boundaries and linkages.
Target group	**Policy-makers**
	Establish a clear regulatory framework that addresses blockages that online learning is faced with today, including: quality assurance mechanisms, credit recognition processes and IPR regulations.
Theme	**Improving student performance through technology**
Target group	**Higher education institutions**
	- Identify the (diverse) needs and circumstances of the learners; - Ensure learner access to relevant technologies and possession of necessary skills to gain maximum benefits from them; - Recognise that the successful introduction of learning analytics will be dependent not only on the choice of technology but on making the institutional changes necessary so that teachers, IT staff and administrators work effectively together to support students; - Provide appropriate processes, tools and support activities so that faculty are able to fully utilise the rich data generated through analytics to enable them to respond to individual student needs and to further develop their teaching; - Clarify the roles of the different actors (within and beyond the institution) involved in meeting these needs;

	• Ensure a collective understanding of the different roles/responsibilities and the relationships between them; • Ensure clear lines of management responsibility and information requirements to assess performance; • Build supportive relationships and trust between the relevant actors (students, academic staff, support staff, IT staff, managers and, where applicable, employers).
Target group	**Policy-makers**
	• Clarify the funding implications, intended outcomes and timescales for the innovation; • Collect and analyse feedback information (from learners, institutions, employers etc) on performance and impact, and inform all relevant actors; • Identify any unintended consequences of the innovation (e.g. for other functions, for widening participation or labour market linkages).
Theme	**Globalisation and multi-campus universities**
Target group	**Higher education institutions**
	• Balance commercial, educational and reputational considerations in formulating overall international strategy; • Address a range of interconnected factors such as student mobility (inward and outward), student placements, qualification recognition, funding implications, curriculum and pedagogic implications, and labour market linkages; • Consider the needs of different actors including home and international students, academic and support staff, quality assurance agencies, employers and sponsoring bodies; • Engage 'home' staff and to build relationships between staff located at the different campuses; • Establish how much to 'export' from the home institution and how much to build to reflect local contextual factors at different campuses; • Establish how much to 'import' from the international activities to reshape the home institution; • How to satisfy different national regulatory and quality assurance regimes.
Target group	**Policy-makers**
	• Providing support for inward and outward mobility of students.

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