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LEAN SIX SIGMA IN HIGHER EDUCATION INSTITUTIONS

The Need to Change

STEPHEN G. ANTHONY
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The Need to Change

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INVESTOR IN PEOPLE

To Gillian, Alex, Misty, Esme, Jeremy and LJ – thank you, Stephen
To my family, Frenie Antony and Evelyn Antony – love, Jiju

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ABOUT THE AUTHORS

Dr Stephen G. Anthony is one of the leading voices in the UK when it comes to deploying Lean Six Sigma outside of the manufacturing sector. Stephen has trained over 5,000 Lean Six Sigma professionals across the world from a variety of sectors including healthcare, finance, governmental agencies, academia and manufacturing. Stephen holds a leadership diploma from Harvard Business School, MBA, Master of Engineering and has been a Master Black Belt for over 15 years. Stephen is currently the Director and Fellow of the Institute of Six Sigma Professionals and has published a variety of articles in leading Lean Six Sigma journals covering leadership and deployment strategies. Stephen is often invited to present his ideas at world-renowned conferences and has run his own Lean Six Sigma consultancy business for over 20 years.

Dr Jiju Antony is recognised worldwide as a leader in Lean Six Sigma methodology for achieving and sustaining process excellence. He is currently serving as a Professor of Industrial and Systems Engineering at Khalifa University in Abu Dhabi, UAE. He is a Fellow of the Royal Statistical Society (UK), Fellow of the Chartered Quality Institute (CQI), Fellow of the Institute of Operations Management (FIOM), Fellow of the American Society for Quality (ASQ), Fellow of the Higher Education Academy, Fellow of the International Lean Six Sigma Institute, Fellow of the Institute of the Six Sigma Professionals (ISSP) and an Academician of the International Academy of Quality (IAQ). He is a Certified Lean Six Sigma Master Black Belt and has trained over 1,200 people as Lean Six Sigma Yellow, Green and Black Belts from over 20 countries representing over 170 organisations in the last 10 years. Professor Antony has coached and mentored several Lean Six Sigma projects from various companies in the UK ranging from manufacturing, service to public sector organisations including the NHS, City Councils, NHS 24, Police Scotland, ACCESS, Business Stream and a number of Universities. Professor Antony has authored over 500 journal, conference and white papers and 12 text books. He has won the outstanding contribution to Quality Management Practice Award in 2019 from the Chartered Quality Institute

(UK); Life time Achievement Award for his contribution to Lean Six Sigma from the International Lean Six Sigma Institute (UK) in 2020 and Outstanding Contribution to Six Sigma Practice award from the Institute of Six Sigma Professionals, UK, in 2021. His book on *The Ten Commandments of Lean Six Sigma: A Guide for Practioners* has won Walter Mazing Book Price in 2021 (International Academy of Quality, USA) and Crosby Medal (American Society of Quality, USA) in 2022.

PREFACE

This book started with a conversation 10 years ago between the authors at a conference dedicated to Lean Six Sigma in higher educational institutions. In those days little research existed and most improvement leaders in higher education worked alone or in small local teams using what little knowledge they had to make it work. The authors knew that if it was possible to transfer the benefits of Lean Six Sigma into the world of academia, then huge potential benefits could be achieved. The key was always going to be to create a vision of how Lean Six Sigma could be successfully deployed beyond simple administrative processes in an academic environment. The start of a research question formed.

Over the next few years Stephen Anthony, under the mentorship of Professor Jiju Antony, decided to research how academic leadership was impacting the current deployment of Lean Six Sigma and the current state of Lean Six Sigma in higher educational institutions. 8 years later, Stephen successfully defended his PhD based on a Leadership Maturity Model for higher educational institutions wishing to deploy Lean Six Sigma as a force for change. In addition Stephen, under Jiju's guidance, was able to publish several articles in leading journals, including defining academic leadership, benchmarking the deployment of Lean Six Sigma in the UK, using Taguchi techniques to complete a systematic literature review, and building and testing a maturity model for deploying Lean Six Sigma in higher educational institutions.

This book is an abridged version of the PhD thesis and will take the reader on a journey from the creation of universities through the global challenges faced by these institutions today and onto a framework to help them deploy change.

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ACKNOWLEDGEMENTS

Over the years of this work the authors have had incredible conversations with academic and Lean Six Sigma professionals relating to how Lean Six Sigma can address the challenges faced by academic institutions. In addition, Stephen Anthony's PhD spanned two universities, 8 years, 6 international conferences and numerous frustrating conversations with his mentor. To create a list is always fraught with danger since many contributors will be missed; however, the authors do need to thank their families, The University of Strathclyde, Herriot Watt University and Emerald Publishing for their support in making first the PhD and then this book happen.

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INTRODUCTION

Lean Six Sigma (LSS) is an Operational Excellence methodology that aims to reduce the costs of poor quality, improve the bottom-line results and create value for both customers and shareholders. LSS has been deployed in organisations in a variety of sectors and cultures for more than two decades. However, its implementation in academic institutions around the world has only just begun to emerge. Furthermore, there is a lack of any empirical evidence to support any successful deployment of LSS in higher educational institutions when addressing the key challenges faced by these institutions today. Therefore, the purpose of this book is to investigate the current status of LSS in academic institutions and present a leadership maturity model to help academic leaders implement LSS in their own academic institutions.

This book is made up of several key pieces of research, including in Chapter 1 a review of academic challenges faced by institution leaders, concluding with the authors' definition of academic leadership. In Chapter 2 the authors present the history of Lean, Six Sigma and the blended approach – Lean Six Sigma. In Chapter 3 the authors present a systematic literature review of papers in the field of LSS and academic leadership published in peer-reviewed and other topic specialist journals, from 2000 to 2020. Chapter 4 is dedicated to a survey looking into the current status of Operational Excellence (OPEX) methodologies in the Higher Education sector. Chapter 5 presents the five characteristics of maturity models needed to develop maturity models used by LSS leaders when deploying change. Chapter 6 follows on from the survey earlier in the book to include a number of semi-structured interviews which provide greater insights into the use of OPEX methodologies adopted by the university sector. Based on the literature review and the findings of the empirical research Chapter 6 concludes with a Lean Six Sigma Maturity Model for higher educational institutions which was developed and tested on a mix of UK and International higher educational institutions, along with a sample of Master Black Belts from the industry. The final chapter summarises the challenges and opportunities for academic leaders as they deliver change within their institutions.

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THE NEED TO CHANGE.....

CHANGE IS NOT NEW IN ACADEMIC INSTITUTIONS

Western Universities, like cathedrals and parliaments, were unique creations in Europe during the Middle Ages. As the Papacy extended its reach across Europe, it became clear that the inward-looking monasteries and cathedral schools could not provide the training needed for the growing number of priests, missionaries and administrators within the church. These old schools and monasteries were not teaching the 'new' ideas of philosophy, mathematics, medicine and law. These new ideas were needed in the changing world the Papacy found itself in during the eleventh century AD. As the church encouraged these old inward-looking institutions to become more outward-looking and more 'modern' in their approaches, new institutions, called universities, were born. Because these new institutions grew slowly and incrementally from around the eleventh century, it has become almost impossible to identify exact birth dates of our oldest institutions, although this has never stopped one claiming an exact date. For example, the University of Bologna is regarded as being the oldest university in continuous operation in the world. This Italian university can trace its origin back to 1088, although it didn't get its formal charter till 1158.

As these institutions began to attract more like-minded individuals and grow, they needed to organise themselves to become more efficient and effective. Administration and infrastructure became the new competencies needed and thus specialisation and faculties were created. Slowly, physical infrastructure began to be created, individuals were housed together to form small communities, quadrangles or 'campuses', and by the thirteenth century AD the 'modern' Western university was born.

The thirteenth century 'ivy league', 'red brick' Western university leaders of that time would have been found in France and England, but student numbers were small, often driven down by famine, war and disease, and many still tied to the church in some form. The new colonies founded in North America had to wait till the 1600s when John Harvard opened his first college, and with the help of other colonialists created the modern day North American higher education system. John Harvard opened his university doors only 15 years after landing in Plymouth but he still built it using medieval ideas around infrastructure, style and Christian values. During this period of expansion, universities grew rapidly in size and number, all driven by a strong reason to exist and strong characters. These strong characters, whether they be settlers or Tudor kings, all had needs which could only be met through the new university machine. Of all the European academic institutions established by 1520, 70 still exist today, centred mainly in France, Germany and the United Kingdom. Besides faith, all were bound by a common language – initially Latin, which interestingly later became German and then, driven in part by the Tudor Kings and Queens, eventually English.

By the 16 century AD, universities were recruiting teachers and researchers from around the Western world and were starting to work beyond their own borders, becoming global institutions. The original founding values of these institutions began to flex and change to meet the needs of a 'global' sixteenth century view of modern society. Even those countries not colonised by the Western powers, such as Japan, Thailand and China, adopted initially the same Western approaches to building centres of learning, having discovered the approach by sharing 'academics' across borders. This globalisation in universities could not be avoided and shows that it is not a new phenomenon. History reveals that when universities shut themselves off from economic and societal trends they become moribund and irrelevant. European universities, for example, ignored both the Renaissance and the Industrial Revolution and some ceased to be relevant. Indeed, the French Revolution swept away the notion of universities entirely due to their aristocratic view of the world, while von Humboldt had to reinvent the German university model in 1809 in order to save the institutions from becoming obsolete. It is interesting to note that throughout history universities, originally set up to meet very specific demands, have needed to change as society around them changes. Institutions and systems do possess great latitude in how they deal with change, for example, globalisation. Those who argue that there is just one model for higher education in the twenty-first century are clearly wrong. There never has been one model for building a successful university and probably never will be due to the varied nature of society.

The emergence of a global education exhibits itself in the form of a variety of multinational higher education initiatives – ranging from 'twinning' programmes linking academic institutions or programmes in one country with counterparts in another, to universities in one country setting up branch campuses in another. As we have seen, the multinationalisation of higher education has historic roots. During the colonial period, universities from Europe frequently set up branch institutions or sponsored new schools in the colonies. Examples include the British in Africa and Asia, Dutch institutions in what is now Indonesia, and French initiatives in Africa and Asia. Roman Catholic universities set up new institutions in Latin America and the Philippines; religious orders such as the Jesuits undertook multinational higher education initiatives. In the nineteenth century, American Protestant missionaries set up universities based on the US model in Lebanon, Egypt and Turkey, among other places. The most interesting fact is that all of these new institutions and initiates were built on the medieval model of research, teaching and administration dating back to the eleventh century AD.

In over a 1,000 years Western universities have not really changed the way they are created or built. However, the reasons for their existence are always different and unique to the university, and the time and society it finds itself in, and the more successfully universities change with the times to meet that need. Some were set up to provide engineers, some were set up to provide doctors, but all can trace their roots back to the time when philosophy, mathematics, medicine, law and faith ruled the day. This strong sense of history, worth and almost entitlement to exist feeds into the culture and characteristics of higher educational institution (HEI) and drives much of the paradigm that is HEI in Western Europe today.

THE CHANGING MODEL AND CHARACTERISTICS OF ACADEMIC INSTITUTIONS

In recent decades, a number of structural changes in society frequently described in terms such as globalisation (although arguably not that new), the information age and the rise of the knowledge-based economy are significantly transforming the way we acquire, disseminate and transform knowledge. These structural changes have resulted in knowledge production becoming closer and more directly linked to a country's economic competitiveness. It could be argued that today's knowledge and competencies play a more critical role than ever before in national economic growth and welfare creation of a

given country or region. Thus institutions are being forced to change their paradigm regarding their role in society and the value they bring to their country. It has become a norm to refer to today's economy as a knowledge-based economy. Knowledge is increasingly becoming 'the' resource, rather than 'a' resource for wealth generation. It is widely recognised that knowledge is the critical asset for an individual as well as an organisation to succeed in the increasingly competitive environment. Universities are there to serve as the platform to enable academics to speak of their knowledge, ideas and insights. One of the common functions of a university is not to just create or share knowledge but also to serve as the knowledge repositories. A trait going back to the Middle Ages, it has always been the practice in HEIs to store all relevant documents contributed by in-house resources in the knowledge repository, library or the database. Today, knowledge is considered as a strategic resource. It is inevitable that we create, store, share and transfer information and knowledge in a continuous flow and for the advancement of society. For more than a decade, academic institutions have struggled with how to manage the collective digital intellectual output they produce. Clearly, due to technological advancement, it is easy to create and access digital material. Paradoxically, however, while there is potential for instantaneous access, all too often many materials are not usually made accessible to many users, and they remain marooned in the institution's collection of disparate databases, computers and libraries.

The need for a university to be relevant in its current era is clear; however the responsiveness of universities, and of the university system, varies considerably among institutions and countries. Universities in many regions of Europe can currently be described as being in a state of crisis, which is caused by their inability to respond to the changing conditions they find themselves in. Thus, many historic universities in Europe currently suffer from some of the same maladies as their counterparts in developing countries: an acute lack of funding, problems with maintaining quality of research and education, and with providing knowledge and education that meet the changing needs of their surrounding society and economy. Historically, universities have been shaped by, drawn their agenda from, and been responsible to the communities that founded them. Thus each generation has established a 'social contract' between the university and the society it serves. If the institution is no longer serving the community and is not prepared to change, why should it exist? Back in 1999 Duderstadt was writing about the need for universities to change to meet the challenges of the coming twenty-first century. He identified five forces exerting pressure on the US institutions which have not changed their thinking for over 300 years.

The five forces were:

The age of knowledge. Western societies are evolving rapidly into a post-industrial, knowledge-based societies, with different needs, desires and expectations.

Demographic change. The US population is becoming increasingly diverse with respect to race, ethnicity and nationality. Women, minorities and immigrants now account for roughly 85% of the growth in the labour force.

The globalisation of the world. Whether through travel and communication, through the arts and culture, or through the internationalisation of commerce, capital and labour, the West is becoming increasingly linked with the global community – something universities have been at the heart of for hundreds of years without realising.

The post-Cold War world. For almost half a century the driving force behind many of the major public investments in national infrastructure has been concern for national security, and protecting country boundaries; defence research funding drove many of the aims and objectives of university departments.

Market forces. Most people generally think of higher education as public enterprise, shaped by public policy and actions to serve a civic purpose. Yet market forces also act on colleges and universities. Society seeks services such as education and research. Academic institutions must compete for students, faculty and resources if it is to survive and be relevant.

THE FUTURE OF ACADEMIA

There is some evidence that universities are embracing new technologies, for example, the internet-based learning management systems (LMS). These systems are designed to help HEI design and teach courses over the internet and are being heavily invested in by some universities especially in the United States and United Kingdom. Although, some will argue that this is a response to the commercial competition brought to the table by large IT firms such as Google and Facebook. In addition to embracing new technology, universities are becoming more commercial-minded, especially through the creation of university 'spinouts'. The rising number of universities involved in commercialisation activities such as licensing and spinning out has been well reported and

documented in several surveys. In the United Kingdom, a sharp rise of spinout creation between 1996 and 2001 has been reported, from an average of 95 per year in the four years up to the end of 2000 to 175 created in 2001. The number of patents and licences in the last decade has almost tripled as these new firms exploit commercially their 'parents" knowledge, technology and research results, developed within the university and historically rarely shared.

After new technologies and commercialisation, the final area where universities are changing is in the way they measure performance. While corporations and public bureaucracies have attracted sociology-based organisational studies since their early modern development, higher education and research institutions as organisations remained for many years a rather unexplored one. Academia is today a key issue on public agendas, on top of financial concerns, and its performances are questioned with respect to their consequences for economic growth and social equality. The 'quality' of a university's output has arguably never mattered more than today.

It is a truism that universities form one of the oldest established institutions in the Western world – far older, for example, than the public limited company or indeed the modern bureaucracy of the nation-state – and despite changes in form, function and fashion, the very latest universities retain some links, however tenuous, with their medieval forebears. Equally, while bodies bearing the title university vary dramatically in terms of their structure, function and form, the very fact that they choose to label themselves as universities rather than any one of a number of other alternatives, for example, 'colleges', 'institutions' or 'centres of learning', suggests at least a desire to capture and share that 1,000-year old tradition. On the one hand, then, it is tempting to see the university as something different or set apart from other organisations – as a unique institution in the modern world. On the other hand, it is also clear that there are many similarities between universities and other organisations.

Table 1 summarises the main characteristics of a university when compared to other types of organisations, for example, manufacturing or profit-driven public sector organisations, and potentially helps the reader in understanding the challenges faced by leaders and change agents within HEIs when trying to deploy organisational change, perhaps by deploying Lean Six Sigma and thus meet the challenges of the twenty-first century.

These differences in characteristics between universities and profit-driven organisations mean that any leader or change agent trying to transfer one management approach or philosophy such as continuous improvement or Lean Six Sigma from the mainstream into a university will need to adapt their approach. In addition they will need to recognise that within a university itself, two contradicting paradigms exist between the informal professional

Table 1. Differences Between HEI and Other Types of Organisational Structures.

Characteristics of a Typical Profit-Driven Organisation	Characteristics of a Higher Education Organisation
• Enhancing shareholder wealth is the main strategic driver • Revenues earned by sale of products and services • Measure of performance is financial bottom line • Find and exploit distinctive competence of firm by positioning it in product or service markets • Strategic triangle aligns financial performance, with organisation survival and with social value	• Achieving social mission is the main strategic driver • Charitable contributions or tax appropriations/government funding • Measures of performance linked to efficiency and effectiveness of achieving the mission Finding better ways to achieve the mission • Strategic triangle does not link social value with financial performance or survival
• Higher scores for corporate visual identity for both management characteristics and management instruments • Actively improve their corporate visual identity • Less open and dynamic towards sharing corporate visual identity data • Strong understanding of business strategy and how it links to corporate visual identity	• Poor scores for management characteristics and management instruments to develop and manage corporate visual identity • Spend little improving and changing their corporate visual identity • More open and dynamic to sharing data with public bodies and institutions • Poor understanding of the links between successfully delivering the mission and strategy and corporate visual identity
• Top management commitment drives success • Customer focus driven by a need to meet and exceed customer satisfaction • Strong human resource management, with broad training and development strategies • Full employee involvement • A focus on process management and benchmarking against outside 'best practice'	• Complex organisations with a strong sense of tradition and culture • Vagueness in their educational mission statement • Anarchy within the organisational governance • The structure is split into administrative and academic silos • Concept of academic freedom and the refusal to tolerate interference from outside sources Changes identify stakeholders and 'clients' of the organisations

Table 1. (*Continued*)

Characteristics of a Typical Profit-Driven Organisation	Characteristics of a Higher Education Organisation
	HEIs are complex with multiple power decision centres combined with a wide range of interests • Classed as Professional Bureaucracies group, not centralised, with two parallel often contradictory hierarchies. • One of complex work, directed upwards, democratically informal in workflows and communication, developed by professionals within their own silos • The other, a standardised systematic logistical support, directed downwards, more like Machine Bureaucracies, with workflows directed and controlled in a formal manner

bureaucracies of the academic staff and the formal machine bureaucracies of the administrative functions.

Whichever approach, model, or culture universities strive to adopt, at the heart of any university is its reason for existence, and its need to maintain its social contract with society. As society changes, a university needs to change with it, and its ability to successfully manage its own change is something within its own power – the role of today's academic leaders has never been more important, and the role of academic leadership never more crucial.

ACADEMIC LEADERSHIP

In a globalised world, all countries are trying to educate their people to enable their nation to prosper, by using 'world class universities': the term used by the United States and United Kingdom to help distinguish between the great and the good. These universities have recognised that today's globalisation is