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Pathways of organisational transformation for sustainability: a university case-study synthesis presenting competencies for systemic change & rubrics of transformation

Alex Baker-Shelley^{a,b}, Annemarie Van Zeijl-Rozema^a and Pim Martens^a

^aMaastricht Sustainability Institute (ICIS), Maastricht University, Maastricht, Netherlands; ^bGreen Office, Maastricht University, Maastricht, Netherlands

ABSTRACT

This research article presents a diagnosis and synthesis of three case studies of universities that have transformed themselves as organisations towards sustainability with signature pathway approaches. These took place in 2016 at Leuphana Universität Lüneburg, Arizona State University, and Hong Kong University of Science and Technology. These universities *first* invested significant time, energy, and human resources in learning about and researching themselves, *before* embarking along differentiated pathways of transformation, in turn, made up of common patterns of rubrics in specific action strategies.

The common patterns delineated by the action strategies can be understood as intrinsic competencies for systemic change. These describe the assets of, for example, actors researching, learning about, and diagnosing their own organisations, their awareness of system boundaries and qualities, and the relationship and interdependency between the organisation and its surrounding society and ecosystems.

Any blueprint of organisational transformation for sustainability should, therefore, be rooted in the intrinsic logic of the organisations in question. 33 tangible systemic rubrics of transformation also emerged which could be useful for actors (whether student, administrative, academic, entre/intrapreneur, leadership or activist) to prioritise asset development within their organisations, and which might act as pragmatic design aspirations, guiding and encouraging university actors along transformation pathways.

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Socio-ecological systems; organisational transformation; sustainability science; universities; systemic change; organisational development

1. Introduction

Universities worldwide have a clear mandate to participate in the endeavour for sustainable development through institutional transformation. Moreover, it is recognised that universities are well-positioned to identify and navigate pathways of transformation towards sustainability given their propensity for consideration of the extended time horizon for sustainability outcomes (Sachs 2015). Yet, despite their being organisations of learning, they struggle to set up structures to promote *their own* organisational learning (Stephens et al. 2008). This is a problematic paradox as researchers repeatedly place universities at the centre of the ‘fundamental transformation of conceptualisation and action’ that sustainable development demands of social actors, organisations, institutions and societies (Barth and Rieckmann 2016). Therefore, universities must also work on their own transformations if they are to operationalise their aspirations to implement sustainable development in their surroundings. This is an especially urgent imperative given the wicked problems they are tasked with providing solutions for, such as relieving anthropogenic pressures on the global environment and attaining population wellbeing in the face of

growing inequality (Koehn and Uitto 2017). This paradox can be formulated as a form of organisational-social fragmentation, where such fragmentation is a function of wicked problems and social complexity (Rittel and Noble 1989; Conklin 2006).

This disclosure presents an attempt to ‘defragment’ this complexity using embedded sustainability science case studies in organisational research of public research universities (**PRUs**) to better understand organisational transformation pathways towards sustainability. Three were conducted in 2016 on pioneering PRUs in three regions of the global higher education sector: Leuphana Universität Lüneburg (**LU**), Arizona State University (**ASU**), and Hong Kong University of Science and Technology (**HKUST**). Research questions applied to each case aimed to unearth competencies, qualities and patterns that distinguished the studied pathways of organisational transformation for sustainability. The long-term organisational development and transformation of these three universities have been diagnosed and interpreted according to a tool developed based on previous work: a meta-theoretical review and conceptual synthesis of core elements and theories of organisational transformation for sustainability into an analytical framework (Baker-Shelley et al. 2017).

The findings exhibit how universities (and actors with them) effectuate and navigate pathways of organisational transformation towards sustainability. Moreover, it appears that extrinsic capacity for transformation or impact in the wider socio-ecological system, and the development of intrinsic capacity for systemic change, are interdependent. The empirics support this postulation by showing how:

- (1) The case universities developed intrinsic capacities or competencies for systemic change;
- (2) Internal organisational development or transformation is catalysed by a stimulus or shock to the system from its surrounding institutional architecture;
- (3) Internal or external stimuli generated a positive impact in the local socio-ecological system via organisational transformation of the university itself.

As an outcome of this case research, a diagnostic tool was developed, consisting of 33 tangible systemic rubrics. These rubrics, refined and tested in this PhD project, appear as useful means to recognise intrinsic logics, assets, competencies and drivers necessary for navigating organisational transformation for sustainability. The rubrics are made tangible by patterns of behaviour, or traits which characterise actors' competencies for systemic change and their own organisations' learning processes. The most highly-weighted rubrics in the data relative to the larger evidence base are described as '*green lights*' for systemic change/transformation: thresholds beyond which the socio-ecological system profoundly and positively changes its equilibrium state. These may prove meaningful for leaders (youth, academic or otherwise) elsewhere to prioritise specific asset development within their organisations, as they show how to shape competencies conducive to organisational transformation for sustainability. They also provide stepping-stones for knowledge actors in universities to navigate organisational and societal transformation towards sustainability, in light of the radical and regenerative adaptation that must now take place in economic and political systems.

2. From metatheoretical review and conceptual synthesis to diagnosis and case-study synthesis

Although cases of campus sustainability management and sustainability in higher education in the last two decades are numerous and diverse, less is known about the outliers, and studies have rarely focussed on small-'n' embedded cases. Hence, this project focussed on pioneering universities selected for their organisational development and transformations

towards sustainability. This article builds on the core elements of organisational transformation for sustainability presented in our previous conceptual article by discerning holistically and practically what this phenomenon entails at universities in practice (Baker-Shelley et al. 2017). That metatheoretical review of five perspectives at three scales goes into detail on the scientific literature and findings that formed the foundation of the case-studies undertaken. In the metatheoretical review conducted in this PhD project, organisational development and organisational transformation were found to be considered as similar yet distinct phenomena. Organisational transformation can be defined by periods of rapid, discontinuous change which punctuate the equilibrium of the prior system (Porras and Silvers 1991; Romanelli and Tushman 1994). Additionally, organisational transformation for sustainability specifically can be explained as involving a holistic view of multiple perspectives (Edwards 2010; Baker-Shelley et al. 2017).

It entails:

- A substantive change in the means, methods and processes by which the subject organisation functions.
- Effective change management leading to societal wellbeing and resilience that allows actors 'equifinality': a choice in the manner of navigating toward its vision along various pathways of transformation, where sustainability is a shared end-goal that is not absolute but guiding.
- Transformation at an individual or group-scale (micro) being nested within organisational learning and self-reflection (meso), which in turn is nested in societal transformation (macro).
- Tending towards a steady-state – in terms of the throughput of an organisation's metabolism – because this state corresponds to minimum entropy production.
- Evolving towards a state of higher resilience in bursts of rapid, discontinuous change, punctuating the sub-optimal equilibrium of the prior system state.

This conceptualisation was structured from many key studies found in the preceding metatheoretical review, which laid out the core elements that crystallise the phenomenon of organisational transformation towards sustainability at universities (Baker-Shelley et al. 2017). As promised in this last article, the elements were streamlined into diagnostic criteria, which could then be interpreted as rubrics once tested in the field. This article fulfils this objective by presenting the results of the diagnostic tool's testing at three case-studies as planned. Rooted in this process, the concept of '*green lights*' for systemic change emerged to indicate how to recognise and induce transformations

from within organisational systems. In other words: positive tipping points or thresholds beyond which transformation towards sustainability may occur along various pathways. This interestingly overlaps with the application of the leverage points concept, where actors may positively intervene in a socio-ecological system (Meadows 1999; Abson et al. 2017). These terms are built on previous literature which pertains to systemic change and transformation at various scales and across various dimensions in socio-ecological systems (Rockström J et al. 2009; Westley et al. 2011; Nuttall 2012).

3. Methodology

3.1. Methods: diagnostic tool

The objective of this research was to generate actionable solutions that ameliorate the pathology of systemic sustainability problems in complex socio-organisational systems – like universities – through diagnosis, interpretation and isolation of deeper underlying symptoms and structures (Keeler et al. 2016). Through iterative-reflexive evaluation at several case studies, a diagnostic tool has been developed. It enables analysis of very different universities from similar perspectives. Upcoming work will present the process of operationalisation in detail: from core elements to diagnostic criteria, categories of analysis, and eventually the tangible systemic rubrics (Baker-Shelley 2020). The operationalisation began with a meta-analysis of appropriate literature across five theoretical perspectives, from which the core elements of organisational transformation were identified and designed into an analytical framework (Baker-Shelley et al. 2017). Towards the purpose of testing the framework, elements were paired with diagnostic criteria and questions which – it was hypothesised – might help identify the relevant information needed to diagnose the case at hand. The structure of the framework was designed using three organisational levels, from individuals and dyads (micro-level/individual) to groups, larger units and departments (meso-level/intra-organisational), to the organisation's relationship with the outside world (macro-level/extra-organisational). It operates across five metatheoretical perspectives (thematic areas): behavioural science and psychology (**BSP**), organisational change management (**OCM**), socio-ecological systems (**SES**), corporate governance for sustainability (**CGS**), and, sustainability in education and research (**SER**).

Applying the framework, the first round of case study analysis was done after the fieldwork at LU. The diagnostic criteria – following the steps of qualitative data analysis – were further refined into categories of analysis that data could be coded with. Their conceptual distinction – ability to encapsulate the data as distinct categories of analysis – was tested

system(at)ically. Following an iterative process of learning through evaluation (Luederitz et al. 2016) and qualitative data analysis (Dey 1993), the data were coded, categorised and interlinked using the categories of analysis; these categories were themselves refined and improved as their application to the case study data progressed. This process eventually produced the 33 tangible systemic rubrics which constitute the Diagnostic Tool for Organisational Transformation for Sustainability at Universities (see Figure 1).

3.1.1. Tool outputs; transformation signatures

Weights were assigned according to the categories of analysis and calculated according to each code's groundedness in the data and density of relationality. Colour-coding each thematic area and re-sizing each rubric larger for higher weight values denote groundedness and density per case.¹ The values were produced by a weighting equation formulated to show proportional performance according to the evidence base and systemic interconnection in the organisations researched. The output rubrics formed stepping-stones in action strategies that were mapped using the diagnostic tool (Figure 1), shown visually with various dashed outlines surrounding them and arrows depicting different associations. More code links indicated a higher value of relational density when significant quotes were shared between codes and verified by other data sources. These associations were corroborated with the value for groundedness for each rubric. The transformation signatures eventually produced in the findings consist of the distinct action strategies identified. They represent the organisations holistically, where specific rubrics comprise steps in the action strategies that effectuated pathways of transformation. See Table 1 for an example of how the type of association was used to present the directionality and intensity of the connections between rubrics. The most significant rubrics define how these universities necessitated and navigated their transformation, through the actions of groups of actors within them.

3.2. Methods: qualitative data analysis

The qualitative data analysis software Atlas.ti² was used to organise, code and interpret the data. Key functions in this software, like the 'network function', enabled codes to be associated using the substance and nature of the data they were grounded in. In this way, Atlas.ti helped test conceptual distinction and association after each case. If one code shared a significant quote with another, these were linked. If more quotes (images or observations based on notes and conversations) were shared, associations became more apparent and notable for their relationship, often explained by the content of the data



Figure 1. Tangible Systemic Rubrics of Organisational Transformation for Sustainability at Universities, based on Baker-Shelley et al. (2017). Own design. Renders the university organisation as a holistic, complex-adaptive system, representing intrinsic competencies for systemic change that may be left tacit in less integrated models. The rubrics represent common qualities and characteristics in social-organisational behaviour for sustainability transformation.

themselves. The data were organised according to the categories of analysis, which were formulated into distinct codes. Dey’s approach (1993) was followed

by applying the analytical techniques of groundedness and density. A weighting exercise was conducted using the numerical values and this allowed

Table 1. Selection of associations made between rubrics at Case 3 HKUST. (Analysis Output: Atlas.ti). These correspond to some, but not all the steps in the three action strategies for brevity. ‘Is associated with’ is dialogical, shown by bi-directional arrows, whereas ‘triggered’ is where one step seems to influence the crystallisation of another – a uni-directional arrow. Where one or two less significant quotes was shared, weak associations were made, marked by less bold arrows.

Source Code	Link Type	Scale	Lens	Target
Rubric/Competence-set				
BSP 1.1 Psycho-social wellbeing	is associated with	Micro-Meso	BSP-BSP	BSP 1.5 Organisational positive behaviour
BSP 1.55 Organisational experimentalism	is associated with	Macro-Macro	BSP-SER	SER 5.6 Minimisation of negative health, socio-economic and environmental effects
OCM 2.3 Purposeful-adaptive evolution	triggered	Meso-Macro	OCM-SER	SER 5.7 Research and education generates societal impact and public awareness
SES 3.1.1 Effective intrapreneurship	triggered	Micro-Micro	SES-SER	SER 5.1 Sustainability Competence Training for Transformation
SES 3.2a Internal governance for sustainability	is associated with	Meso-Meso	SES-	CGS
CGS 4.2a Internal Evaluation of Environmental Social Governance				
CGS 4.1 Strategic trajectory, liaison and learning	is associated with	Micro-Meso	CGS-SER	SER 5.5 Sustainability research demonstration, knowledge enterprise
CGS 4.1 Strategic trajectory, liaison and learning	triggered	Micro-Meso	CGS-	CGS
CGS 4.2a Internal Evaluation of Environmental Social Governance				
CGS 4.3 Externality Recognition & Internalisation	is associated with	Meso-Meso	CGS-SES	SES 3.1.2 Effective transformative leadership
SER 5.1 Sustainability Competence Training for Transformation	is associated with	Micro-Meso	SER-SER	SER 5.5 Sustainability research demonstration, knowledge enterprise
SER 5.1 Sustainability Competence Training for Transformation	is weakly associated with	Micro-Micro	SER-BSP	BSP 1.2 Pro-sustainability behaviour

an evaluative lens to be applied, attaining some level of proportionality which could be visualised.³

3.2.1. Types of data and stakeholders targeted for interview

The types of data included 144 primary documents consisting of 35 semi-structured interview transcripts, and a range of other written and visual data⁴: strategic reports, internal/annual reports, sustainability reports, university websites, expressions of sustainability on campus, third-party audits, transcribed research notes from key meetings, and exploratory conversations with actors about the university's sustainability activities. In these conversations, the actor's roles, opinions and expectations within their organisations were discussed. These actors had several roles: academic staff, members of executive boards/leadership, administrative staff, and students and alumni from PhD, Masters and Bachelors programmes. Some locals were also informally interviewed to help discern the university's community environment. Given that previous research suggests using 12 interviews per case as a marker for data saturation (Guest et al. 2006; Mason 2010; Baker and Edwards 2012), and that semi-structured interviews are not the only form of data used to analyse our phenomenon (Laforest and Bouchard 2009), it was considered that sufficient data saturation had been reached to produce the diagnostic tool.

3.2.2. Equation and procedure for evidence-based weighting

$$W = \frac{Gr_c}{N_q} \times \left(100 + \frac{De}{10} \right)$$

The equation for evidence-based Weight **W**, factors the numeric values for groundedness of a category **Gr_c**, against the total number of coded quotes, **N_q**, considering the function of conceptual density, **De**. Dividing by 10, plus 100, made the weighting value easier to scale and visualise in terms of distribution and frequency. '**W**' thus signifies the weight for a specific category of evidence in proportion to the total amount of data relative to the interconnection between categories.

3.3. Empirical background: a synopsis of three pioneering universities

The three embedded case studies were selected as outliers because they were undergoing or had recently undergone organisational development/transformation. Their inner sustainability journeys were initially discerned from the antecedents and background of the universities; for example, their organisational design, institutional architecture and wider societal,

environmental, economic and political conditions. Summaries of these empirical backgrounds follow.

3.3.1. Leuphana University Lüneburg

Despite its size, at over 9000 students and 1160 staff, Leuphana University Lüneburg (**LU**) stands out for its approach to sustainability, innovation, and entrepreneurship (Kempton and Hofer 2015). It underwent an extensive period of experimentation and restructuring, guided by key leadership figures, university management, administrative staff, as well as the engagement and intrapreneurship of teams of professors and students. Numerous student associations, agencies, councils, and start-ups also appear to have driven this organisational transformation. Through the formal and informal efforts of the faculty, students and staff, initiatives coalesced in high-level leadership support and the implementation and formalisation of a whole faculty for social and natural sustainability sciences. Representatives from each faculty were installed in liaison with the environmental coordinator, via various sub-units, with explicit legitimacy, resources and decision-rights allocated. This resulted in an evolution in governance for sustainability, performance enhancement and social responsibility. LU's sustainability coordination was seen to form a cohesive network for dialogical communication throughout the organisation (Bakhtin 2006), working against fragmentation and silo-based cultures. The results of the OECD-funded Innovation Incubator (Kempton and Hofer 2015), positively exemplified the initiatives, strategies, programmes and reconceptualisation kicked off by the Faculty of Sustainability's practice of transdisciplinarity and sustainability competence training. The structures of governance for sustainability at LU are an outcome of this, representing formalised evidence of intrinsic systemic change and the triggering of awareness for the necessity of sustainable development in the region.

3.3.2 Arizona State University

Arizona State University (ASU), founded in 1885, is a large PRU, with a total student enrolment in 2018 surpassing 100000, with around 4500 academic staff, mostly in Tempe and Phoenix, USA. Early in the 2000's, social, environmental, cultural and political drivers in Arizona triggered a major departure from traditional models of US PRUs (e.g. Ivy League, Gold Standard, Land Grant universities). The transformation of ASU into the New American University prototype was led and initiated by Michael Crow from 2002, who conceived of 'an egalitarian institution committed to academic excellence, inclusiveness to a broad demographic and maximum societal impact' (President's Office 2015). This unfolded in an experimental approach to institutional innovation, grounded

in open systems theory and the biological metaphor of 'the interaction between an organism and its environment' (Crow and Dabars 2015, p. 63; Katz and Kahn 1978).

ASU thus innovated an organisational and cultural design termed a 'complex-adaptive knowledge enterprise', linking specialised, university-wide, interdisciplinary research initiatives, and transdisciplinary configurations. These configurations develop solutions to complex global challenges, ranging from population growth, urbanisation, automation, to space exploration, across diverse disciplines (ASU 2016). There are dozens of notable examples, however, these three suffice for this section:

- The Consortium for Science Policy and Outcomes (CSPO), reconstituted in 2004 from the previous Columbia-based initiative 'Through an NSF⁵-funded project, on decision-making under uncertainty for climate change' (Crow and Dabars 2015, p. 285).
- The Complex Adaptive Systems Initiative (CASI), a 'collaborative effort to address ... challenges in health, sustainability and national security' (Crow and Dabars 2015, p. 279).
- And, the Julie Ann Wrigley Global Institute of Sustainability⁶ (GIOS) that includes ASU's School of Sustainability (SOS), and the Global Consortium of Sustainability Outcomes (GCSO). GCSO was established in 2015 as a federation of universities and research institutes that collaborate to develop, test, teach and transfer potential solutions to worldwide sustainability problems. They aim to reduce, eliminate or deflect a sustainability problem by applying research-based practical solutions, termed as sustainability outcomes (Tromp et al. 2015).

3.3.3. Hong Kong University of Science & Technology

Hong Kong University of Science and Technology (HKUST) was established in 1992, with approximately 15500 students, and 650 academic staff in autumn 2018. It boasts a scenic campus with excellent facilities for leading-edge knowledge creation in science and technology. It is committed to interdisciplinarity, the wellbeing of its students and staff, and has made considerable progress to embed sustainability into its core and supporting processes. HKUST's long-term vision on sustainability was implemented through a 5-year plan called the *HKUST 2020 Sustainability Challenge*. Examples of its implementation efforts include the counselling and mindfulness centre for students, and the 2016 strategic programme executed by senior leadership, assigning specific portfolio responsibility to themselves in the process. Five cross-faculty clusters

subsequently resulted from 'a demanding consultative process involving all 20 of the University's departments and divisions together with senior research management': Data Science, Sustainability, Design Thinking and Entrepreneurship, Autonomous Systems and Robotics, and Public Policy (HKUST 2016; Lim et al. 2016). These are interpreted as transdisciplinary research and education focal points for the HKUST community.

HKUST is part of a network of eight University Grants Committee (UGC) funded universities working together in the Hong Kong Sustainable Campus Consortium (HKSCC). HKSCC promotes regional cooperation, solutions sharing and agreements so that all member universities, as well as Hong Kong as a whole, can make progress towards mutual goals like reducing carbon emissions, plastic pollution and improving solid waste management (HKSCC 2017). At the core of HKUST's sustainability activity is an organisational design exhibited by the Division of Environment and Sustainability and the HKUST Sustainability Unit nested within it. HKUST adopted an experimental approach, opening up their campus as a living laboratory, and kickstarting the Sustainable Campus Leadership Program, using the university setting to provide 'a unique opportunity to demonstrate real-world lessons in real-world conditions' (HKUST 2014).

4. Results: synthesis and cross-case comparison

Common patterns and differentiated pathways of transformation are presented in the following section. The most significant rubrics are presented in transformation signatures per case (4.1). These charts visualise the rubrics, with their size altered according to their weighting. Thereafter, a scalar (4.2) and thematic (4.3) comparison of the transformation signatures isolates the most significant patterns, telling us how these universities navigated their transformations towards sustainability. Shared qualities and clusters of action are then discussed followed by the conclusions (5.0). In all three of the transformation signatures, depicted in Figures 2–4, action strategies were mapped onto the template of the diagnostic tool (Figure 1), their proportional sizes altered according to their respective weights and connectedness.

4.1 Transformation signatures

4.1.1. LU transformation signature

The LU transformation signature consists of three action strategies, shown in **orange** (A), **black** (B) and **turquoise** (C) in Figure 2.

LU Action strategy A 'Sustainability competences and environmental literacy', shown in Figure 2 in **turquoise**, connects the micro-level to the meso-level and can be

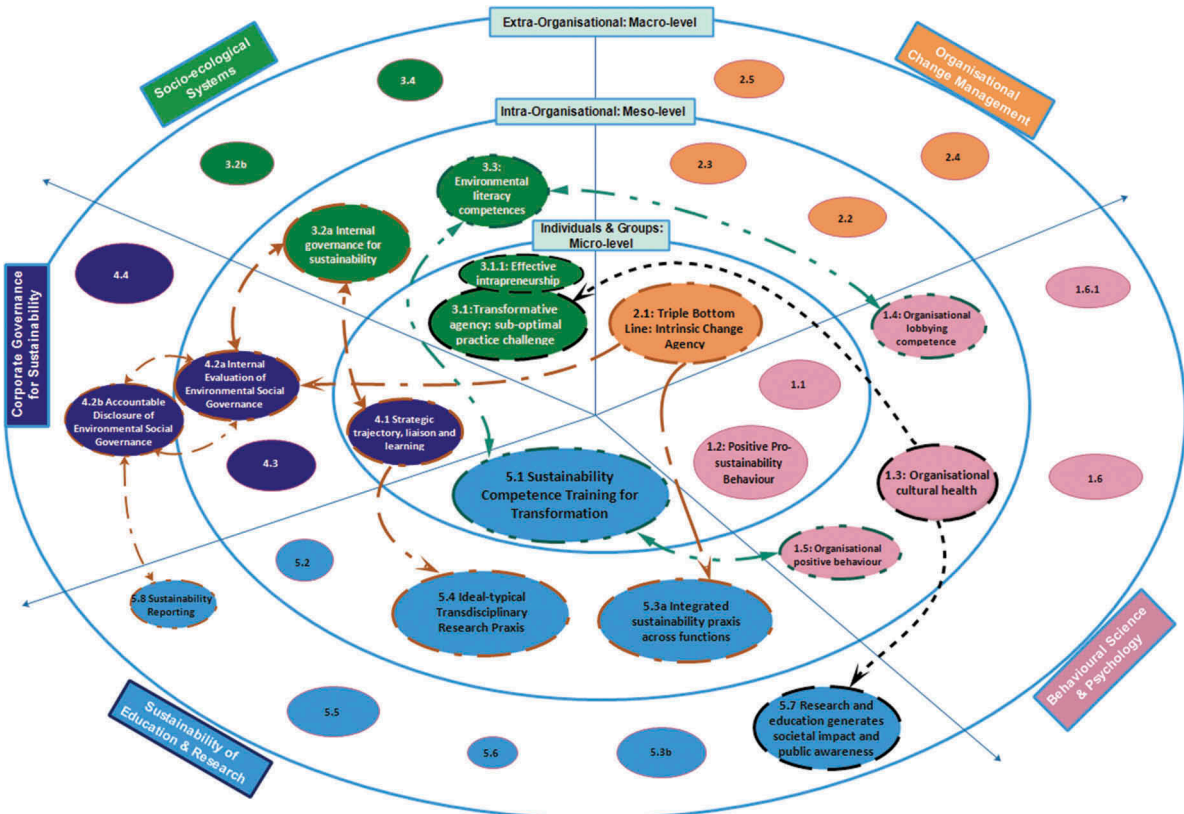


Figure 2. LU transformation signature. Own design by Baker-Shelley using E-Draw mind mapping software. Three distinct strategic chains of action taken by change-agents connected by the internal evidence are shown in **orange** (A), **black** (B) and **turquoise** (C).

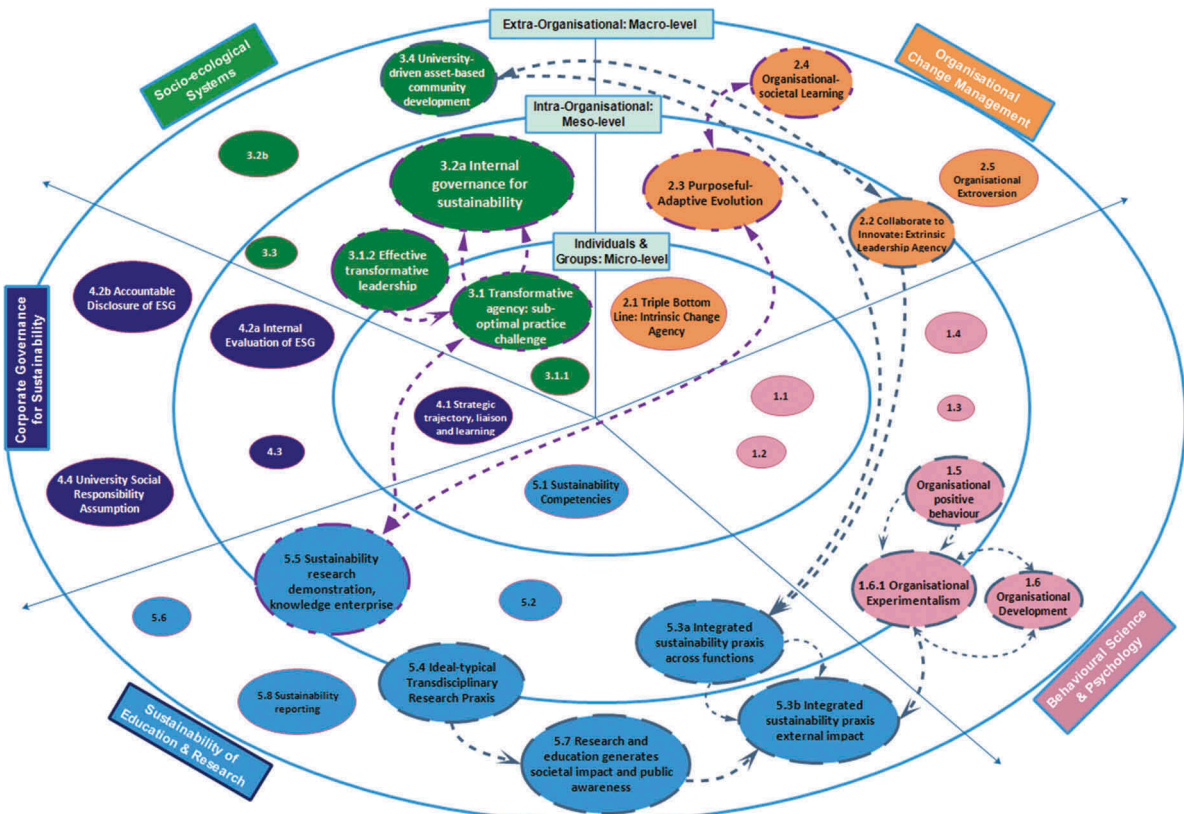


Figure 3. ASU transformation signature. Own design by Baker-Shelley using E-Draw mind mapping software. Two distinct strategic chains of action taken by change-agents connected by the internal evidence are shown in **purple** (A) and **blue-grey** (B).

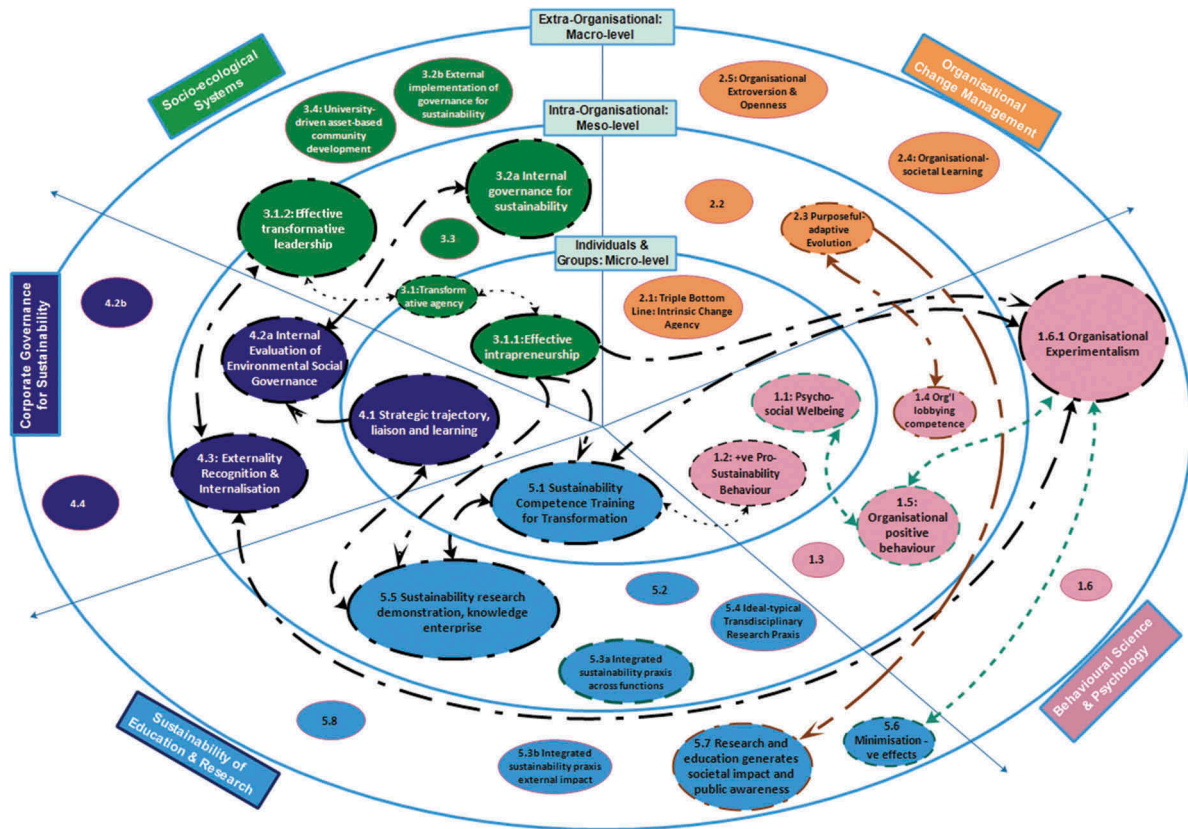


Figure 4. HKUST transformation signature. Own design by Baker-Shelley using E-Draw mind mapping software. One major strategy interlinked with one of two minor strategic chains of action taken by change-agents, shown in **black** (A), **brown** (B), and **turquoise** (C).

characterised by the implementation of sustainability competencies at the individual-dyad level in Leuphana (SER 5.1). The sustainability minor within LU's 'Leuphana Semester' introduces its approach to sustainability competence training for students and staff, referred to in its sustainability reporting and the Leuphana 'Sustainability Science Initiative as Competence-building in Sustainability' (Schaltegger 2009). This action strategy links sustainability competencies with environmental literacy in the socio-ecological systems theme (SES 3.1), as well as positive behaviour (BSP 1.5) and lobbying (BSP 1.4) in behavioural science and psychology. Multi-scalar awareness of power and agency, and of the material and social environment, presented themselves in many of the meetings with LU researchers and staff⁷

LU Action strategy B 'Environmental evaluation and governance' is shown in **orange** scaling across three levels. It is rooted in the strong ability of LU actors to manage and account for their triple-bottom-line (OCM 2.1), measuring how their university complements people, planet and profit responsibilities. Multiple references to EMAS training and diversity in the documentation and sustainability reporting was linked to integrated sustainability praxis (SER 5.3a), and a cluster of evaluation and disclosure of environmental social governance (ESG) at the meso and macro levels (CGS 4.2a & b). These also linked into the use

of interdisciplinary resources and sustainability standards (SER 5.8) (e.g. the Global Reporting Initiative) at a macro-level, and back across into internal governance for sustainability (SES 3.2a), strategic trajectory at the micro-level (CGS 4.1), and ideal-transdisciplinary research praxis (SER 5.4), at the meso-level.

LU Action Strategy C 'Sustainability research and education, and intrapreneurial outreach' appears in **black** with a significant scalar range and research and education marked by triggering external impact and awareness (SER 5.7). It seems rooted in the micro-level qualities of transformative agency and effective intrapreneurship (SES 3.1–3.1.1). These were interrelated with organisational cultural health (BSP 1.3) which, in turn, was seen to affect the appearance of impactful, awareness-raising research and education. A joint project with ASU in Kosovo and Albania exemplified this, with LU as the European basis of projects maximising societal impact and public awareness, with many international partners. They received several awards for such research projects within the UNESCO Decade for ESD (nine Project Awards in total since 2006) based on LU's chronological evolution (LU 2010).

Transformation signature of LU: summary

Three action strategies show that sustainability competencies and environmental literacy,

environmental evaluation and governance, as well as sustainability research and education, and intrapreneurial outreach, all played an important role in LU's transformation.

4.1.2. ASU transformation signature

At ASU the transformation signature includes two action strategies, shown in **purple** (A) and **blue-grey** (B) in Figure 3.

ASU Action Strategy A, 'Agency, leadership, reflexive governance and organisational learning in the region' in **purple**, depicts transformative agency concerning the challenging of sub-optimal practices (SES 3.1), particularly characterised by effective transformative leadership (SES 3.1.2), linked to internal governance for sustainability (SES 3.2a). This aspect is in turn interestingly linked to the rubric for sustainability research demonstration (SER 5.5), as the top-down redesign of ASU by Crow shows. SER 5.5 is associated with ASU's ability to learn about itself and its societal surroundings (OCM 2.4). Crow's office researched the history of university institutional models, grounding ASU's New American University Prototype as a new iteration (President's Office 2012). Thus, we see the link with the purposeful-adaptive evolution of ASU (OCM 2.3). Furthermore, this links into ASU's sustainability governance structure for sustainability (SES 3.2a) which has evolved into a functional system relative to the size of ASU and the scale and scope of its activities as a comprehensive knowledge enterprise.

The effective governance and demonstration of sustainability in the organisation substantiates ASU's role in the Phoenix-Tempe-Mesa region's transformation towards sustainability indicating their departure from traditional governance modes. Transdisciplinary configurations also form a part of this purposeful-adaptive evolution, as well as internal governance structures, like the Office for Knowledge Enterprise Development, and the Centre for Science, Policy and Outcomes,⁸ reconstituted in 2004 from the previous Columbia-based initiative (Crow and Dabars 2015, p. 285).

ASU Action Strategy B 'Transdisciplinary sustainability research and education, praxis and organisational experimentalism' in **blue-grey** occurs mostly at the meso- and macro-levels. Notable is the incidence of transdisciplinary research praxis (SER 5.4). Several interviews with staff members reference ASU education and research generating societal impact and public awareness (SER 5.7), including the Dean of SOS and the Joint Director of GCSO: Programs '*created and generated from ASU and from GIOS in terms of the sustainability consortium [are] having a big impact on supply chains and businesses and corporations*', which act as best practices including '*other organisations that*

are having impacts in the larger community. Like DCDC, Decision Centre for a Desert City,' and GCSO as '*a vehicle by which we can scale a lot of this work and knowledge that we've generated within the university so that we'll have a larger more global impact*' (Nixon-Carter 2016). Evidence shows the presence of the rubric cluster denoting integrated sustainability praxis (SER 5.3a), illustrating how effectively integrating sustainability across portfolio functions spills-over externally (SER 5.3b) through ASU's various spin-off communities; for example, the SkySong Center (President's Office ASU. 2012), and trans-institutional networks such as GCSO. SER 5.3b is interestingly connected to ASU's ability to run test-beds, and campus labs, shown by the rubric organisational experimentalism (BSP 1.6.1), in close connection with organisational development at the macro-level (BSP 1.6), partially orientated by positive organisational behaviour (BSP 1.5). Further links across into leadership agency for response to extrinsic drivers (OCM 2.2), and university-driven community development (SES 3.4) show significant internal processes connected to external impulses ASU makes for the public good.

Transformation signature ASU: summary

Two action strategies show that agency, leadership, reflexive governance and organisational learning in the region (A), as well as transdisciplinary sustainability research and education, praxis and organisational experimentalism (B) played an important role in ASU's transformation.

4.1.3. HKUST transformation signature

At HKUST, the transformation signature consists of three action strategies, coloured **black** (A), **brown** (B), and **turquoise** (C).

HKUST Action Strategy A, 'sustainability demonstration and competence training, transformative leadership, governance, and experimentalism' is a major strategy, corresponding to the chain in **black** in Figure 4. There are many links between and across scales, however, key associations are notable between the micro-level rubrics of transformative agency (SES 3.1), effective intrapreneurship (SES 3.1.1), strategic trajectory (CGS 4.1) and sustainability competence training (SER 5.1). These undergird significant meso-level rubrics, such as internal evaluation of ESG (CGS 4.2a), sustainability research demonstration (SER 5.5), and effective transformative leadership (SES 3.1.2). SER 5.5 is corroborated by documentary and verbal accounts concerning the HKUST 2020 Sustainability Challenge and its respective Action Plan. Creating more visibility for sustainability features and research was influenced directly by the recommendations of an external advisory group for the operations committee installed on sustainability to '*[i]dentify projects that ... have an obvious educational benefit, and then install them in highly visible*

places where they become the focus of the campus community' (HKUST Sustainability Unit 2016). Accordingly, to achieve the 2020 Sustainability Challenge, a 'Sustainability Corner' was recommended by the operations committee, to permanently display in a highly visible manner *'efforts the university has undertaken, demonstration of University-driven research, and exhibition of new and promising technologies that will push the sustainability boundaries in the future'* (HKUST Sustainability Unit 2017). Rubrics are also inter-linked across the meso and macro-levels of CGS and BSP. Here the associations particularly focus on BSP 1.6.1, organisational experimentalism, showing HKUST's propensity to physically, socially, economically and ecologically transform its surroundings.

HKUST Action Strategy B 'lobbying competences, purposeful-adaptive evolution, sustainability research and education for external impact', (in **brown**) is a distinct pathway between organisational lobbying competences (BSP 1.4), purposeful-adaptive evolution (OCM 2.3), and societal impact and public awareness of research and education (SER 5.7), the association of which is supported by interviews at the HKUST Sustainability Unit, yielding information concerning:

- the identification of HKSCC,⁹
- the HKUST Research and Graduate Studies department, which performs impact cases to determine the extent to which HKUST research outcomes impact its surrounding society.
- HKUST's participation in GCSO, which demonstrates the awareness of external actors of its impacts and potential.
- The account given that the HK government needs HKUST as much as the other way around, which shows public awareness for the capabilities of HKUST.

HKUST Action Strategy C 'student and staff wellbeing, positive inspiration and experimentalism' is a minor pathway, shown in **turquoise**, which overlaps with action strategy A in its culmination at organisational experimentalism (BSP 1.6.1) at the macro-level, undergirded by psycho-social wellbeing of students and staff (BSP 1.1), and organisational positive behaviour (BSP 1.3). Whilst these lower scale rubrics reinforced BSP 1.6.1, it associates too with the less significant capacity to minimise negative health, socio-economic, and environmental effects of HKUST (SER 5.6) at the interface with the wider world. The HKUST Sustainability Unit report of 2013/2014 illustrates this action strategy in context: *'Since the university is constantly changing, the Sustainability Unit supports this transformation in ways that make it more healthy, inspiring, and environmentally responsible. The goal is to support operational units as they undertake actions that improve the campus environment; faculty as they use the campus as a living*

laboratory for new ideas and demonstrations of research; and students who want to improve conditions through their hands-on actions' (HKUST Sustainability Unit 2014).

Transformation signature HKUST: summary

Many interlinkages show one major and two minor action strategies: firstly, a highly prominent one, 'sustainability demonstration and competence training, transformative leadership, governance, and experimentalism'; secondly, 'lobbying competences, purposeful-adaptive evolution, sustainability research and education for external impact'; and, thirdly, 'student and staff wellbeing, positive inspiration and experimentalism'.

4.2 Scalar comparison

4.2.1 Micro-level comparison

There are diverse patterns at the micro-level per case. LU has the highest weighted rubrics, reflected in its own sustainability competence training programmes as described in LU Action Strategy A. Worthy of note, ASU is a much larger institution with many different organisational units in comparison to LU. Therefore, the strength of ASU's rubrics of transformative agency (SES 3.1) and triple bottom line accounting (OCM 2.1) is significant. Comparing ASU's level of pro-sustainability behaviour (BSP 1.2) and effective intrapreneurship (SES 3.1.1) with LU, these rubrics are much more pronounced, which supports the attestation by some GIOS/SOS alumni for bottom-up student engagement to be better enabled and connected across campus. Differences are more subtle once we compare HKUST and LU. HKUST micro-level performance looks more balanced, with similar proportionality according to their presence in the data. At HKUST, psycho-social well-being (BSP 1.1) and strategic trajectory, liaison and learning (CGS 4.1) are more pronounced, which the analysis suggested was due to a visible and accessible campus counselling centre, indicating that HKUST ensures the wellbeing of its students and staff.

4.2.2 Meso-level comparison

The differences are more pronounced at the meso-level. Purposeful-adaptive evolution (OCM 2.3) is most significant at ASU, due to its redesign as a complex-adaptive knowledge enterprise. Whereas ASU slightly lacks pronouncement in the areas of organisational cultural health (BSP 1.3) and environmental literacy competencies (SES 3.3), where LU and HKUST excel more. Internal governance for sustainability (SES 3.2a) and transformative agency (SES 3.1) are highly present in all three cases, exemplified by the renewed sustainability governance structure at LU in 2016/17, ASU's transdisciplinary configurations, and HKUST's 2020

Sustainability Action Plan. Integrated sustainability praxis across functions (*SER 5.3a*) and ideal-typical research praxis (*SER 5.4*) are also equally present in all cases, except at HKUST where it is less pronounced.

One major difference that marks HKUST out against ASU and LU, is the high level of pronouncement of *SER 5.5* with regards to how it demonstrated sustainability-related research physically on campus, concretely seen in HKUST's 2020 Sustainability Challenge (HKUST Action Strategy A above). Nevertheless, in Phoenix, sustainability research exhibition (*SER 5.5*) was also pronounced, whilst it seemed orientated more towards communications and disclosure of ASU research and education that specifically benefits the public (*SER 5.7*). These two rubrics indicate how the case universities leveraged knowledge of sustainability, whilst implementing it in practice to achieve organisational or societal impact.

Box 1: Examples of *SER 5.4 Transdisciplinary Research Praxis*.

- references to trimodal pedagogical models, interdisciplinary major and research programmes at HKUST (HKUST 2016).
- the application of ASU's fourth pragmatic design aspiration, 'Pasteur's principle' or use-inspired research (ASU 2004).
- the design and implementation of new interdisciplinary colleges and schools (e.g. SOS) at ASU (Clark et al. 2004).
- the 'Lüneburg approach' of intermediate-level collaboration amongst sustainability activists, higher education policy and administration (Adomßent et al. 2007, Lang et al. 2012).

4.2.3 Macro-level comparison

The macro-level shows the greatest differences. ASU's cluster of organisational positive behaviour (*OCM 1.5*), organisational development (*OCM 1.6*), and organisational experimentalism (*OCM 1.6.1*) is highly pronounced and unique. HKUST and ASU both excel more generally than LU, with many more pronounced rubrics. Except for accountable disclosure of ESG (*CGS 4.2b*) with sustainability reporting (*SER 5.8*), which allows LU to punch above its weight. This may have been due to the small size of Leuphana compared to the other two and the limitations of external documentary evidence translatable from German. However, due to the significance of the OECD-funded Innovation Incubator, and LU's specific focus on societal impact at the strategic level in 2017, the local community appeared increasingly aware of university-driven initiatives.

Subsequently, significant rubrics indicated university-regional interdependency; these are all equally highly present at HKUST, ASU and LU. Internal evidence strongly suggests that the research and education performed in each case produce some impact and the public is aware of this (*SER 5.7*). Additionally, although more pronounced at ASU and HKUST, university-driven assets-based community development

(ABCD) (*SES 3.4*) provides an example of how researchers, students and practitioners lead by forming partnerships with civic actors to find innovative solutions to drive societal transformation. Lastly, the presence of *SER 5.3b*, at ASU especially, and to a lesser extent at HKUST, shows how sustainability practices embedded in research, education, operations, governance and communications (*SER 5.3a*) encourage university community actions, increasing the likelihood of developing resilient and sustainable lifestyles externally.

4.3. Thematic area comparison

4.3.1 Behavioural science and psychology

The most prominent rubrics are spread broadly across scale levels at LU. HKUST is also strong in this area and has more strategic actions assigned to BSP rubrics; LU, however, shows the most balanced distribution. Aside from its cluster at the macro-level (*BSP 1.5, 1.6.1, 1.6*), ASU has limited BSP pronouncement. HKUST's experimentalism, defining its macro-level organisational culture, illustrates how it uses its campus as a testbed for sustainability and innovation in science and technology. This is demonstrated by the presence of psychosocial wellbeing and organisational positive behavioural traits, which appear to bolster the ability to run campus-level experiments, without risk aversion or fear-of-failure.

4.3.2 Organisational change management

In organisational change management, each case shows a similar distribution. Except for a more pronounced weighting of triple-bottom-line agency (*OCM 2.1*) in LU. Given the inertia created by competition with much larger regional universities, it is logical that LU had to, therefore, develop its intrinsic competencies to punch through the 'glass-ceiling' created by this competition and institutional architecture. LU's transformation appears driven from the bottom-up, through change-agents taking active responsibility at the group-level to manage the triple bottom line of operations and decision-making, taking account of social and environmental risks, obligations and opportunities. However, at higher levels, we see ASU and HKUST have more substance. A purposeful-adaptive mode of change management rooted in anticipation and proactivity was identified in ASU. This seems especially due to Crow's strong influence in ASU's redesign as the New American University prototype, reflecting the assets of the following rubrics: transformative agency/leadership (*SES 3.1/3.1.2*), purposeful-adaptive evolution (*OCM 2.3*), and organisational experimentalism (*BSP 1.6.1*). Whilst HKUST is characterised by the attributes of triple-bottom-line (*OCM 2.1*), organisational extroversion and openness (*OCM 2.5*), organisational-societal learning (*OCM 2.5*), and – in the context of one action strategy – purposeful-adaptive evolution

(OCM 2.3). This depicts a pragmatic yet collaborative resilience in HK universities, exemplified by HKUST's role in the HKSCC, and inter-organisational components regarding how universities impact their surrounding regions.

4.3.3. Socio-ecological systems

Each case has well-grounded SES rubrics at the micro and meso-level, especially concerning transformative agency, effective intrapreneurship and transformative leadership (SES 3.1, 3.1.1, and 3.1.2¹⁰). LU's attributes more strongly associated with transformative change-agency and effective intrapreneurship compared with ASU and HKUST. The SES perspective shows notably more distinguished associations per case. For example, internal governance for sustainability (SES 3.2a) seems to rely on the presence of transformative agency (SES 3.1) at the micro-level at ASU, its strongest asset. Whereas, at HKUST, we see a markedly stronger presence of external governance for sustainability (SES 3.2b) compared to ASU and LU, demonstrating that knowledge of good governance of natural resources is developed and implemented for other organisations and societal actors. University-driven ABCD (SES 3.4) is similarly present at HKUST and ASU. Overall, LU shows more micro-level weighting, ASU more weighting towards the meso-level, and HKUST towards meso-macro.

4.3.4. Corporate governance & social responsibility

HKUST demonstrated significant CGS-rubrics at the micro- and meso-level, with strategic trajectory (CGS 4.1), internal evaluation of ESG (CGS 4.2a) and externality recognition and internalisation (CGS 4.3). LU showed the most similarity to HKUST, except with less pronouncement. However, at LU, the combination of CGS 4.2a and 4.2b shows the asset of internally evaluating ESG performance twinned with accountable disclosure in sustainability reporting and communication. This was also seen at ASU, yet they were not so well associated with other rubrics in the identified action strategies. Only LU's performance in this area shows a balance across scales and rubric presence. Were it not for a lack of substantive evidence collected when evaluating for externality recognition (CGS 4.3) at ASU, then this may also have been similar for the American case.

4.3.5 Sustainability in education and research

Out of all the thematic areas, SER shows the greatest difference in groundedness, association and scale. Both LU and HKUST perform strongly with regards to sustainability competence training (SER 5.1); however, LU shows the highest grounding. The greatest weighting towards the macro-level can be seen at ASU, where sustainability praxis-external

impact (SER 5.3b), sustainability research demonstration (SER 5.5), research and education generates societal impact (SER 5.7), and sustainability reporting (SER 5.8) are all fairly strong and balanced. SER 5.5 occurs more at the macro- than the meso- level for ASU and vice-a-versa for HKUST, exhibiting greater association. Presence of SER rubrics at LU is not so well distributed, apart from sustainability competence training (SER 5.1), integrated sustainability praxis across functions (SER 5.3a), ideal-typical transdisciplinary research praxis (SER 5.4), and research and education generates societal impact (SER 5.7). Interesting similarities are seen once all three cases' performances are compared across rubrics SER 5.3a, 5.4, and 5.7. Only at ASU are all three of these rubrics associated together in the same action strategy at the meso- and macro-level. This is an important indication of how its internal competencies, developed at GIOS, manifested in the relationship with the region, as ASU's action strategy B was closely connected to the cluster in the behavioural science and psychology theme.

5. Discussion & conclusions

5.1. Discussion: shared qualities & clusters of action

The synthesis of each case has unearthed certain shared qualities and clusters of action which discern internal and external leverage of organisational transformation for sustainability.

5.1.1 Internal leverage: shared qualities¹¹ among the case studies

A first shared quality at the micro-level was transformative agency and intrapreneurship, in combination with sustainability competence training of students and staff, a focus on the triple-bottom-line, and the strategic trajectory, liaison and lobbying of engaged actors. These traits delineate intrapreneurs' strategic capability, as well as their persuasion and leverage of those higher up the pecking order who have more say over the nature and direction of the sustainability transformation pathway taken. This is termed the 'liaison' function.

Secondly, at the meso-level, a quality of mutual intelligibility and dialogical communications across disciplines and departments revealed itself, in line with Bakhtin's (2006) dialogical communications theory. This is termed the 'matrix' function, which counters siloed-thinking and institutional isomorphism, due to the often-fragmented structure of university organisations. This function corresponds with seeing the university as a complex-adaptive knowledge enterprise, where 'self-determination is the crux of the

distinction between the bureaucratic mindset of an agency and the boundary-spanning dynamism of an academic enterprise' (Crow and Dabars 2015, p. 307). Although hard to pinpoint exactly, common threads appeared in the rubrics for internal governance for sustainability, organisational positive behaviour and transformative leadership.

A third shared quality aligned with the rubric of integrated sustainability praxis, where sustainability practices are embedded in research, education, operations, governance and communications (*SER 5.3a-b*), encouraging university-community co-creativity and generating awareness of the societal impact of the universities' research and education (*SER 5.7*). Benessia et al. (2012) corroborate our application of the concept of 'sustainability praxis'¹², and its external impact when utilised by universities, as when: 'sustainability is fruitfully hybridized with artistic research and practice ... These hybrids can work as encouragements to abandon modern divides and pitfalls, and engage in a new kind of collective diagnosis and praxis for our present' [predicament] (Benessia et al. 2012).

Thus, application of the diagnostic tool yielded specific patterns of interdependent qualities, occurring across scales and thematic areas. One wonders if this interconnectivity itself is a systemic quality which allows for the action strategies to emerge.

5.1.2 External leverage: clusters of action

Commonalities also seemed to extend to the transnational relationship between the case studies and other universities. During the fieldwork, the nascent GCSO network was discovered, which aims to implement sustainability outcomes at scale in various geographical and socio-economic contexts that have the best problem-solution fit. This network exemplifies how universities can amplify the impact of their research and learning about themselves by sharing solutions and implementing knowledge outcomes at a transnational scale (Keeler et al. 2016). What was remarkable about GCSO was that it confirmed ASU, LU and HKUST as early members, which was not known at the time of choosing the case studies. In this way, GCSO illustrates that sharing experiences and implementing lessons learnt in different contexts collaboratively may spur the development of intrinsic competencies for systemic change. Hence, to the extent that actors within each university organisation benefitted from the shared knowledge and collective research projects allowed by inter-organisational networks, they were better equipped to transform their immediate organisational contexts using this newly acquired agency within their institutional architecture.

In terms of the power and agency to influence the transformation of an organisation from within, further external leverage can be garnered with insider efforts working in collaboration with external organisations

and change-agencies across sectors and scales. These avoid a prescriptive implementation of policies that negate affected communities' capacity to articulate their own problem situation; their agency in understanding their socio-ecological system can be amplified by working alongside sustainability scientists in co-research teams (as rubric *SES 3.4* exemplifies). Different examples occur in the evaluation to support this, with LU's innovation incubator, then ASU's cooperative project with LU in Albania, and with the identified example at HKUST of HKSCC.

5.2. Conclusions

5.2.1. Generic lessons, unique pathways of transformation

Generically, the cases derived success and progression in their academic missions from the extent to which they generate positive societal impact via their education, research and practice. The steps they take to include the public and make them aware speak to this orientation. Demonstrably, the very academic mission of the university can be scaled as a knowledge enterprise, making the outcomes of scientific research visible and creating an impact within the wider community. This perspective aligns with Hessels, van Lente and Smits' (2009) conceptualisation of the university's science-society contract, and its credibility cycle regarding how 'scientific practice relates to external pressures' and 'how internal developments influence science's relationship with society' (Hessels et al. 2009, p. 398).

However, each case study university followed unique pathways; some common rubrics were seen but commonalities in their action strategies were hard to discern. Thus we may conclude that highly specialised approaches to organisational transformation exist. It follows that high context-dependency influences each university's approach to navigating organisational development/transformation for sustainability. Furthermore, interlinkages between significant rubrics across scales demonstrate that external economic and social shocks act as stimuli that trigger universities to develop the intrinsic capacity for systemic change. With the empirics, such stimuli included:

- the institutional transformation of the higher education sector in Germany as a result of unification from the 90's to the '00's, opening up competition in Lower Saxony, driving LU's own restructuring (Wolter 2004);
- a trend of increased cuts of fiscal state higher education funding by almost 50% in Arizona over the period 2002–2012, driving the leadership change and subsequent reconceptualisation at ASU from 2002 onwards (ASU 2013);

- the dramatic transformation of Hong Kong from a manufacturing to a service-based economy with a connected economic slow-down, justifying the policy recommendation to establish HKUST in 1992 (Lee 2013, Schenk 2008).

5.2.2. *Intrinsic competencies for systemic change, rubrics of transformation*

The patterns identified by the action strategies represent intrinsic competencies for systemic change. These, in turn, consist of actors researching, learning about and diagnosing their own organisations, their awareness of system boundaries and qualities, and the relationship and interdependency between the organisation and its surrounding society and ecosystems. It is with these patterns that the elementary substance of the rubrics of transformation maintain a core commonality across three different international contexts, whereas their combination in practice and sequence is unique. This is supported by previous work that states ‘comprehensive reconceptualisation of an organisation or institution must ... proceed according to its own intrinsic logic, especially in the case of an institution as complex as a major research university’ (Crow and Dabars 2015, p. 64).

In conclusion, it was noted that the rubrics assist interpretation of qualitative findings from case-study research. This ideally requires rigorous internal research from within the organisation *on itself*. The diagnostic tool may *substantiate potential for transformation*: internal or external stimuli trigger capacity-building, where university actors may improve performance across rubrics *by scoping ways to enhance intrinsic competencies for systemic change*. In this way, the ‘soil’ can be tested to see whether a particular organisation is a fertile ground for transformation or if more asset development is needed. Hence, tangible systemic rubrics may act as pragmatic design aspirations, guiding and encouraging university actors along transformation pathways.

More discussion, best practice, and guidelines for future research and (transformative) change-agents based on this PhD research project are forthcoming. This work will include lessons learnt regarding a further application of the diagnostic tool - and about the tool itself - from an insider action research case-study of Maastricht University from 2014–2019. Whereas this article has focussed on the synthesis of three university case studies, and their intrinsic competencies with certain rubrics of transformation for sustainability, the forthcoming will strive towards concrete conclusions regarding how universities generally navigate organisational transformations for sustainability. Altogether, this should outline the stark transformational imperative for universities, since they are expected to play profound and unprecedented roles throughout the rest of this century in which humanity will be judged

by its capacity for self-transformation in response to global sustainability challenges; namely, climate change, environmental degradation, biodiversity loss, refugee crises, inequality and resource scarcity.

Notes

1. See Appendix 2.
2. <https://atlasti.com/>.
3. See **Appendix 2** for results of the weighting exercise; **Appendix 3** for the semi-structured interview framework.
4. At the core of the data collection and organisation process was active journaling, which included detailed notes and observations, not only of the interviews whilst they were being conducted but also of remarkable or interesting conversations and meetings. The research notes for all three cases formed the backbone of the data.
5. National Science Foundation, USA.
6. GIOS is the primary vehicle by which the university establishes and pursues a comprehensive set of goals on sustainability education, research and practice, along with the department of University Sustainability Practices.
7. Greater detail of the quotes and data used to draw these observations is provided in the forthcoming PhD thesis and subsequent stand-alone reports of each case study for publication in 2020.
8. CSPO Centre for Science, Policy and Outcomes, a Columbia-based initiative of 1997; reconstituted in 2004 as a ‘transdisciplinary configuration’ at ASU.
9. Hong Kong Sustainable Campus Consortium.
10. Effective transformative leadership, showing qualities of the top-down redesign of the organisation, and change-agency in leadership, was a data-informed code, developed inductively at ASU; this was not applied retrospectively to LU’s data.
11. Hermeneutic units were merged producing aggregated weights per rubric and cross-case associations.
12. Based on Arendtian Praxis in the *vita activa*; as part of the inherent function of political life in change-agency. Praxis is something the actors do to create *möglichkeitsräume* (possibility spaces), in response to stimulus but not the stimulus itself. In this sense ‘action’ allows intrinsic competencies to emerge. The nature, form and substance of action is rooted in the intrinsic logics of the organisation and its actors.

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Appendices

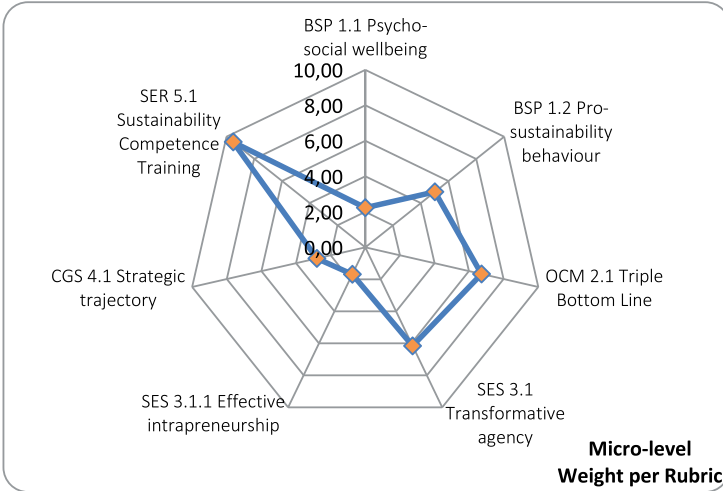
Appendix 1. Tangible Systemic Rubrics of Transformation, Tabulated Rubrics according to thematic areas and scale-levels.

RUBRIC NAME	Full Theme Name	SCALE-LEVEL
RUBRIC NAME		SCALE-LEVEL
Full Theme Name		
	Behavioural Science and Psychology	
BSP 1.1 Psycho-social wellbeing		Micro
BSP 1.2 Pro-sustainability behaviour		Micro
BSP 1.3 Organisational cultural health		Meso
BSP 1.4 Organisational lobbying competence		Meso
BSP 1.5 Organisational positive behaviour		Meso
BSP 1.6.1 Organisational experimentalism*		Macro
BSP 1.6 Organisational action research*		Macro
	Corporate Governance for Sustainability	
CGS 4.1 Strategic trajectory, liaison and learning		Micro
CGS 4.2a Internal Evaluation of Environmental Social Governance		Meso
CGS 4.2b Accountable Disclosure of Environmental Social Governance		Macro
CGS 4.3 Externality Recognition & Internalisation		Meso
CGS 4.4 University Social Responsibility Assumption		Macro
	Organisational Change Management	
OCM 2.1 Triple Bottom Line: Intrinsic change agency		Micro
OCM 2.2 Collaborate to Innovate: extrinsic change-agency		Meso
OCM 2.3 Purposeful-adaptive evolution		Meso
OCM 2.4 Organisational-societal learning		Macro
OCM 2.5 Organisational extroversion & openness		Macro
	Sustainability in Education and Research	
SER 5.1 Sustainability Competence Training for Transformation		Micro
SER 5.2 Intergenerational and socio-ecological ethics		Micro-Meso
SER 5.3a Integrated sustainability praxis across functions		Meso
SER 5.3b Integrated sustainability praxis external impact		Macro
SER 5.4 Ideal-typical Transdisciplinary Research Praxis		Meso
SER 5.5 Sustainability research demonstration, knowledge enterprise		Meso-Macro
SER 5.6 Minimisation of negative health, socio-economic and environmental effects		Macro
SER 5.7 Research and education generates societal impact and public awareness		Macro
SER 5.8 Sustainability reporting standards and instruments implemented		Macro
	Socio-Ecological Systems	
SES 3.1.1 Effective intrapreneurship		Micro
SES 3.1.2 Effective transformative leadership		Micro-Meso
SES 3.1 Transformative agency: sub-optimal practice challenge		Micro
SES 3.2a Internal governance for sustainability		Meso
SES 3.2b External implementation of governance for sustainability		Macro
SES 3.3 Environmental literacy competencies		Micro-Meso
SES 3.4 University-driven asset-based community development		Macro

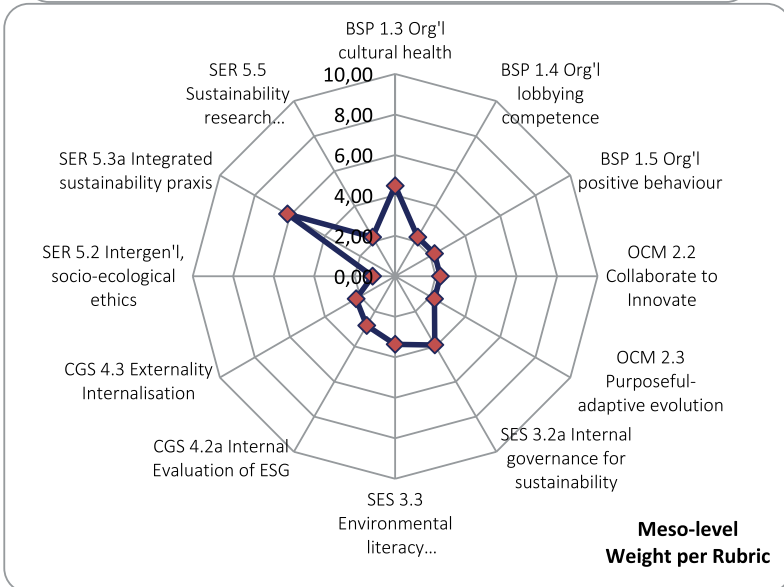
Appendix 2: Results of Evidence-based Weighting with the Diagnostic Tool per Rubric

Leuphana Universität Lüneburg, Weighting with ID-Tool, 2016/2017, Total coded data bits $N_q = 179$

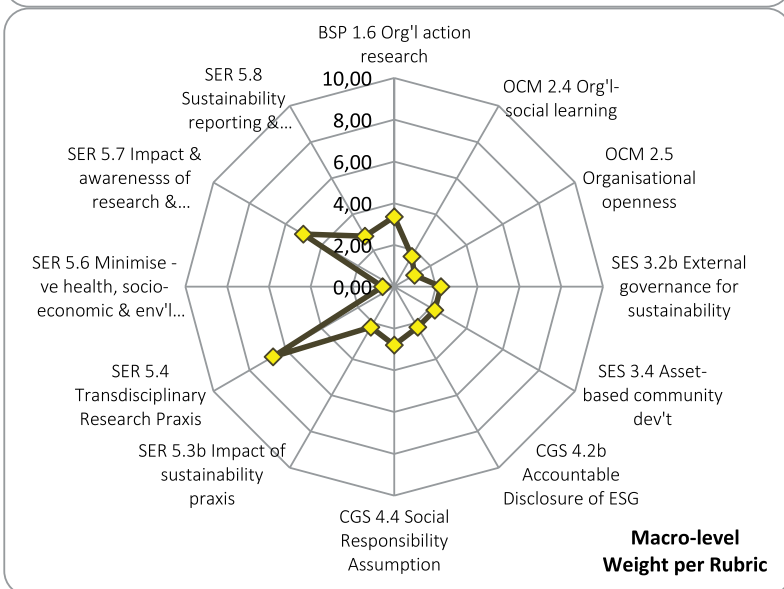
Highly weighted rubrics >W=3.5 in green



Rubric	Gr _c	De	Weight
BSP 1.1	4,00	0,00	2,23
BSP 1.2	9,00	0,00	5,03
OCM 2.1	12,00	2,00	6,72
SES 3.1	11,00	2,00	6,16
SES 3.1.1	3,00	1,00	1,68
CGS 4.1	5,00	2,00	2,80
SER 5.1	17,00	2,00	9,52



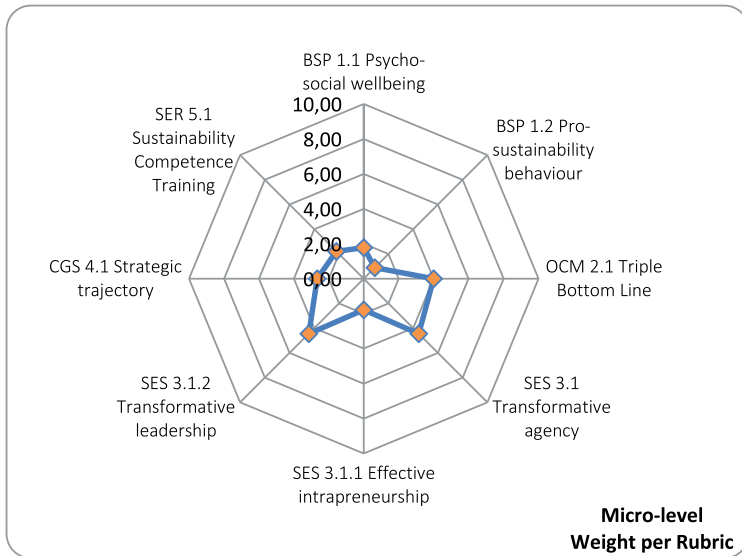
Rubric	Gr _c	De	Weight
BSP 1.3	8,00	2,00	4,48
BSP 1.4	4,00	1,00	2,24
BSP 1.5	4,00	1,00	2,24
OCM 2.2	4,00	0,00	2,23
OCM 2.3	4,00	0,00	2,23
SES 3.2a	7,00	2,00	3,92
SES 3.3	6,00	2,00	3,36
CGS 4.2a	5,00	3,00	2,80
CGS 4.3	4,00	0,00	2,23
SER 5.2	2,00	0,00	1,12
SER 5.3a	11,00	1,00	6,15
SER 5.5	4,00	0,00	2,23



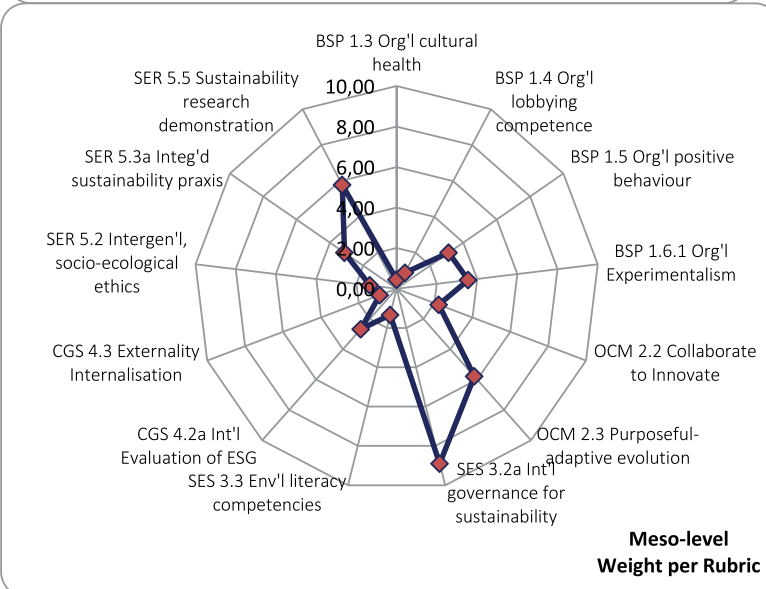
Rubric	Gr _c	De	Weight
BSP 1.6	6,00	0,00	3,35
OCM 2.4	3,00	1,00	1,68
OCM 2.5	2,00	0,00	1,12
SES 3.2b	4,00	0,00	2,23
SES 3.4	4,00	0,00	2,23
CGS 4.2b	4,00	2,00	2,24
CGS 4.4	5,00	0,00	2,79
SER 5.3b	4,00	0,00	2,23
SER 5.4	12,00	0,00	6,70
SER 5.6	1,00	0,00	0,56
SER 5.7	9,00	1,00	5,03
SER 5.8	5,00	1,00	2,80

Appendix 3: Semi-structured Interview Template

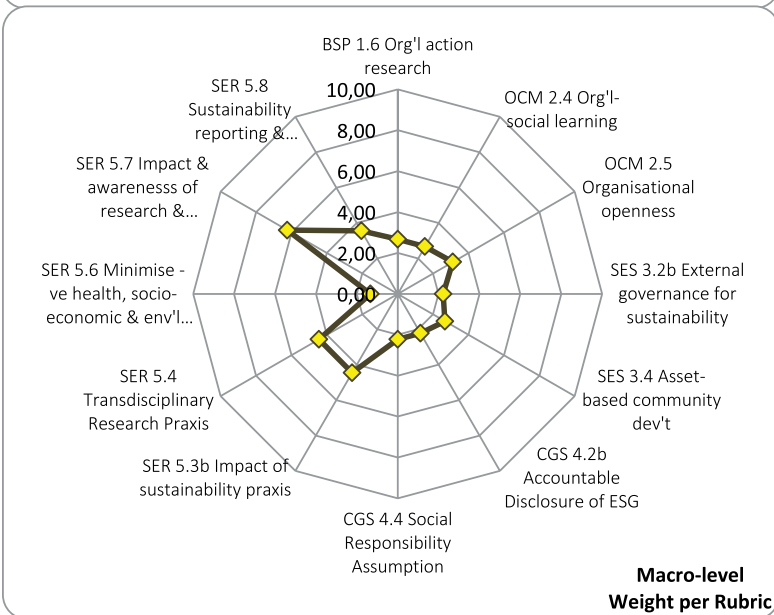
Arizona State University, Weighting with ID-Tool, 2016/2017: Total coded data bits $N_q=225$



Rubric	Gr _c	De	Weight
BSP 1.1	4,00	0,00	1,78
BSP 1.2	2,00	0,00	0,89
OCM 2.1	9,00	0,00	4,00
SES 3.1	10,00	1,00	4,45
SES 3.1.1	4,00	0,00	1,78
SES 3.1.2	10,00	0,00	4,44
CGS 4.1	6,00	0,00	2,67
SER 5.1	5,00	0,00	2,22

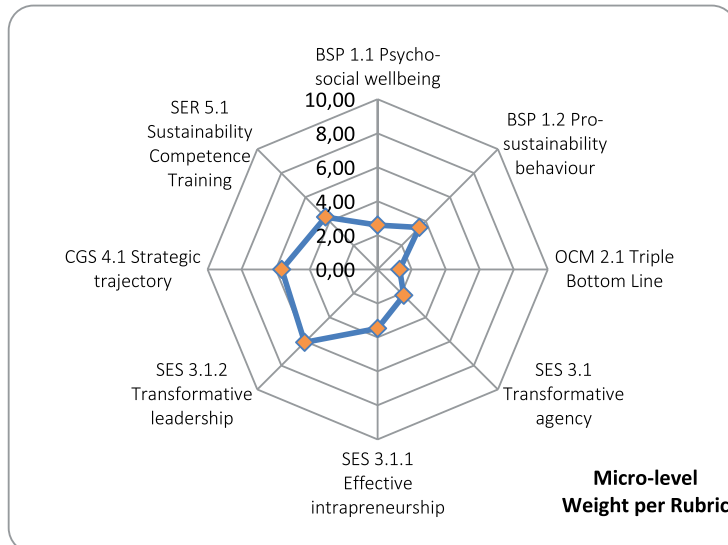


Rubric	Gr _c	De	Weight
BSP 1.3	1,00	0,00	0,44
BSP 1.4	2,00	0,00	0,89
BSP 1.5	7,00	1,00	3,11
BSP 1.6	8,00	2,00	3,56
OCM 2.2	5,00	2,00	2,23
OCM 2.3	13,00	1,00	5,78
SES 3.2	20,00	1,00	8,90
SES 3.3	3,00	0,00	1,33
CGS 4.2	6,00	1,00	2,67
CGS 4.3	2,00	0,00	0,89
SER 5.2	3,00	0,00	1,33
SER 5.3	7,00	3,00	3,12
SER 5.5	13,00	0,00	5,78

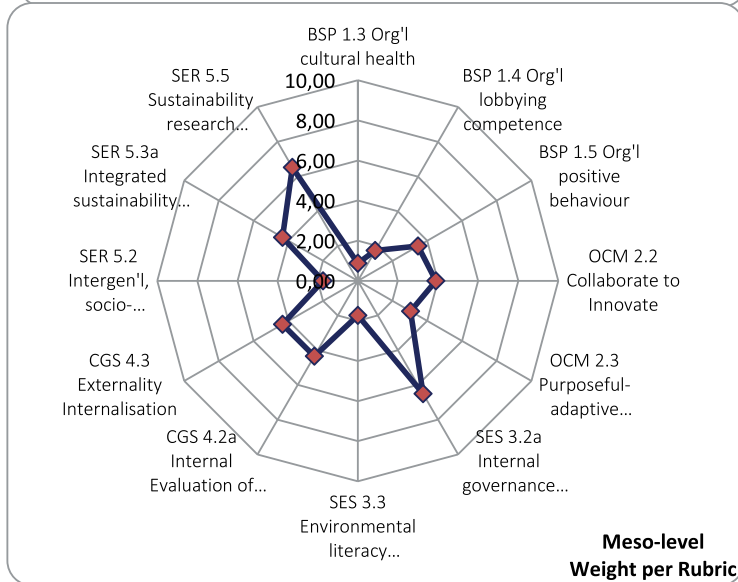


Rubric	Gr _c	De	Weight
BSP 1.6	6,00	1,00	2,67
OCM 2.4	6,00	1,00	2,67
OCM 2.5	7,00	0,00	3,11
SES 3.2	5,00	0,00	2,22
SES 3.4	6,00	2,00	2,67
CGS 4.2	5,00	0,00	2,22
CGS 4.4	5,00	0,00	2,22
SER 5.3	10,00	2,00	4,45
SER 5.4	10,00	1,00	4,45
SER 5.6	3,00	0,00	1,33
SER 5.7	14,00	2,00	6,23
SER 5.8	8,00	1,00	3,56

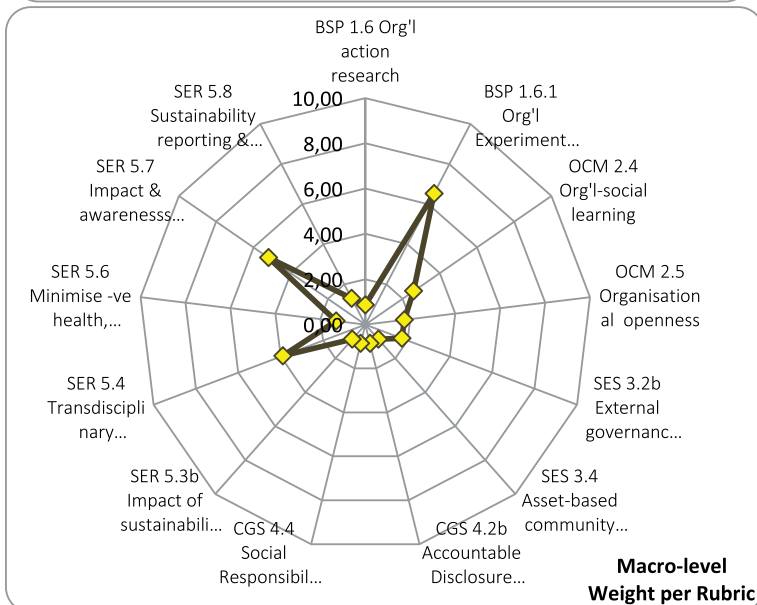
Hong Kong University of Science & Technology, Weighting with ID Tool, 2016/17: Total coded data bits $N_q=214$



Rubric	Gr _c	De	Weight
BSP 1.1	6,00	1,00	2,60
BSP 1.2	8,00	1,00	3,47
OCM 2.1	3,00	0,00	1,30
SES 3.1	5,00	2,00	2,17
SES 3.1.1	8,00	4,00	3,48
SES 3.1.2	14,00	2,00	6,07
CGS 4.1	13,00	2,00	5,64
SER 5.1	10,00	3,00	4,34

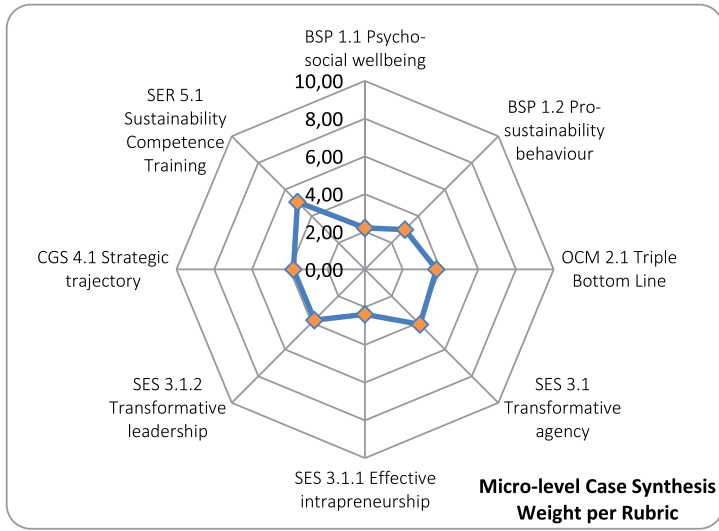


Rubric	Gr _c	De	Weight
BSP 1.3	2,00	0,00	0,87
BSP 1.4	4,00	1,00	1,73
BSP 1.5	8,00	2,00	3,47
OCM 2.2	9,00	0,00	3,90
OCM 2.3	7,00	2,00	3,04
SES 3.2	15,00	1,00	6,50
SES 3.3	4,00	0,00	1,73
CGS 4.2	10,00	2,00	4,34
CGS 4.3	10,00	2,00	4,34
SER 5.2	4,00	0,00	1,73
SER 5.3	10,00	0,00	4,33
SER 5.5	15,00	4,00	6,52

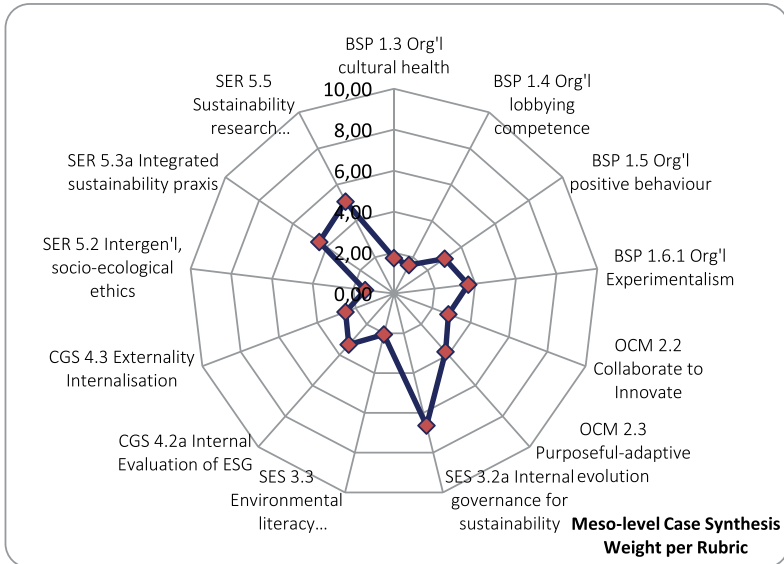


Rubric	Gr _c	De	Weight
BSP 1.6	2,00	0,00	0,87
BSP 1.6.1	15,00	5,00	6,53
OCM 2.4	6,00	0,00	2,60
OCM 2.5	4,00	0,00	1,73
SES 3.2b	4,00	0,00	1,73
SES 3.4	2,00	0,00	0,87
CGS 4.2b	2,00	0,00	0,87
CGS 4.4	2,00	0,00	0,87
SER 5.3b	2,00	0,00	0,87
SER 5.4	9,00	0,00	3,90
SER 5.6	3,00	1,00	1,30
SER 5.7	12,00	1,00	5,20
SER 5.8	3,00	0,00	1,30

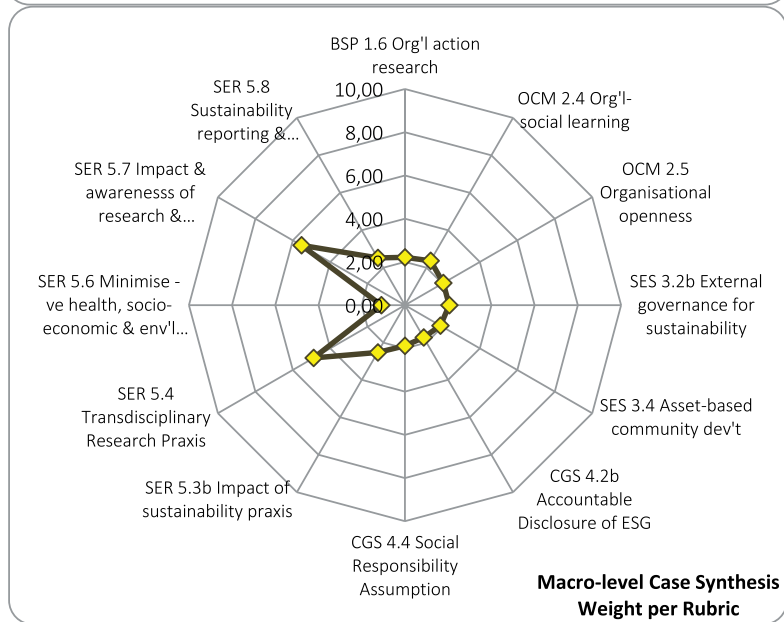
Synthesis LU, ASU, HKUST: Integrated evidence-based weighting using ID-Tool; N_q= 635



Rubric	Gr _c	De	Weight
BSP 1.1	14,00	1,00	2,21
BSP 1.2	19,00	1,00	3,00
OCM 2.1	24,00	2,00	3,79
SES 3.1	26,00	5,00	4,11
SES 3.1.1	15,00	4,00	2,37
SES 3.1.2	24,00	2,00	3,79
CGS 4.1	24,00	5,00	3,80
SER 5.1	32,00	5,00	5,06



Rubric	Gr _c	De	Weight
BSP 1.3	11,00	2,00	1,74
BSP 1.4	10,00	2,00	1,58
BSP 1.5	19,00	4,00	3,00
BSP 1.6.1	23,00	8,00	3,65
OCM 2.2	18,00	2,00	2,84
OCM 2.3	24,00	4,00	3,79
SES 3.2a	42,00	4,00	6,64
SES 3.3	13,00	2,00	2,05
CGS 4.2a	21,00	5,00	3,32
CGS 4.3	16,00	2,00	2,52
SER 5.2	9,00	0,00	1,42
SER 5.3a	28,00	5,00	4,43
SER 5.5	32,00	6,00	5,07



Rubric	Gr _c	De	Weight
BSP 1.6	14,00	1,00	2,21
OCM 2.4	15,00	2,00	2,37
OCM 2.5	13,00	0,00	2,05
SES 3.2b	13,00	0,00	2,05
SES 3.4	12,00	2,00	1,89
CGS 4.2b	11,00	2,00	1,74
CGS 4.4	12,00	0,00	1,89
SER 5.3b	16,00	3,00	2,53
SER 5.4	31,00	2,00	4,89
SER 5.6	7,00	1,00	1,10
SER 5.7	35,00	4,00	5,53
SER 5.8	16,00	2,00	2,52

A: Personal Association and Relation to Sustainability Efforts: [Corresponding code family: Individual, micro]

- (1) *What position do you have in the organisation?*
- (2) *Do you know anything about sustainability efforts on campus?*
- (3) *How are you involved with sustainability projects?*
 - a) *How so? Please provide some examples.*
- 4) *How would you individually define sustainability?*
 - a) *What does it mean to you?*
 - b) *Do you know if the university has a definition?*
 - c) *Do you have a view on this?*

B: The University's Sustainability Performance: [Corresponding code family: Intra-organisational, meso]

- 5) *Are you aware that there is a sustainability report that tracks the progress of the university?*
 - a) *Do you have an opinion on it?*
 - b) *How do you think the university's overall sustainability performance is going?*

C: Sustainability Transformation Pathway: [Corresponding code family: Intra-organisational, meso]

Assuming all organisations should partake in a transformation to higher sustainability and better resilience (of our economies, societies and environment), we can see them as having certain pathways to this end.

In policy, this is usually called the sustainability 'vision', 'mission' and/or mid-term and long-term goals.

- 6) *What direction is the university taking here?*
 - a) *What roles are people taking?*
 - b) *Do you think the university is on the right track?*
 - c) *How does your organisation's path to sustainability look, in the near-term, 2-5 years?*

D: Leverage Points for Action: Implementing Paths to Sustainability: [Corresponding code family: Intra-organisational, meso & Extra-organisational, macro]

Leveraging pathways towards sustainability, we can find internal and external factors that help the transformation along. Sometimes located internally as groups of people, policies or practices, but also externally in the same light. We can call these 'levers for action'.

- 7) *What actions have been taken or are currently being used to implement the path to sustainability?*
- 8) *What barriers or obstacles have there been/ are there preventing this pathway from taking shape? Please give some examples?*
- 9) *How can internal and external levers for action be best put to use to surmount or overcome these barriers?*

E: Stakeholders and agents in the transformation pathway: [Corresponding code family: Intra-organisational, meso]

Once specific individuals are involved and invested in the transformation, we can see different types of social groups working, such as social entrepreneurs (not embedded in the organisation), social intrapreneurs (nested in the university), change-agents, sustainability champions, and/or liaison officers (often the sustainability coordinator must liaise and coordinate between faculties).

- 10) *Do you know of any people engaged as agents and/or stakeholders in the sustainability transformation at Leuphana?*
 - a) *What types of stakeholders are there in the implementation of the pathway to sustainability?*
 - b) *What role do these parties have in the sustainability transformation?*
- 11) *Would you classify these stakeholders and the roles they play as social intrapreneurs, entrepreneurs or change-agents?*
 - a) *Which of them are most effective at playing their role?*
- 12) *Is there anything you would like to add? Who do you think I should be talking to?*