

Chapter 4

Technologisation as the Planetary Solution for Environmental Care and Social Progress? Critical Questions to Vocational and Adult Education

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Intertwinement of Adult and Vocational Education with Technologisation

In this chapter, we discuss the potential of adult, vocational and higher education in addressing the challenges of environmental care and social progress, from the perspective of technologisation, reflecting on its economic, political and idea-historical connections.¹⁴¹ We concentrate on dependencies, conditions and prerequisites that are usually blanked out in research on adult, vocational and higher education.

Recently, the dominant environmentalist and social progressivist agendas emerging from the Global North have been seemingly contradictory. The survivalist rationale of environmental care is translated into greening of economic growth, which would allow the continuation of ways of life that are considered as social progress – even though they are factually behind the worsening environmental crises.¹⁴² The notions of Global North and Global South are commonly based on ‘development’: the North being economically, socially, politically and educationally developed, and the South under or less developed and lagging the North. However, reflections on the planetary condition cannot ignore that the

¹⁴¹We have to postpone discussing relations between our basic concepts, such as economy, environment, politics and metabolism (with reference to ‘oikos’, intertwining of human and earthly ‘household’) to another context.

¹⁴² Steffen, W., Broadgate, W., Deutsch, L., Gaffney, O., Ludwig, C. (March 2015). The trajectory of the Anthropocene: The Great Acceleration. *The Anthropocene Review*, 2(1). <https://doi.org/10.1177/2053019614564785>; Görg, C., Plank, C., Wiedenhofer, D., Mayer, A., Pichler, M., Schaffartzik, A., & Krausmann, F. (2020). Scrutinizing the Great Acceleration: The Anthropocene and its analytic challenges for social-ecological transformations. *The Anthropocene Review*, 7(1), 42–61; IPCC (2022). *Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press. <https://www.ipcc.ch/report/ar6/wg2>

‘development’ of the North has built on colonisation and exploitation of the South, leading to growing environmental and social problems, especially caused to the Global South.¹⁴³ Colonisation and exploitation are complex phenomena, and the hegemonic project of ‘development’ can be traced within both the Global North and the Global South.¹⁴⁴ Still, to start with, we assume Finland and Germany to represent the Global North and Bangladesh to be an example for the Global South.

In Section 2, we comment on some features in the project of technologisation (also called technicism) in the Global North, mainly in German-speaking Europe and Finland, which we think have been influential for interpretations of adult, vocational and higher education and their transfer to the Global South. From an educational perspective, we find critical the ethical, anthropological and political essence of the project and the central role ‘progress’ plays in it. Although it is not possible to realise it in this context, we believe that understanding technologisation would require cross-disciplinary historicisation. Therefore, we reflect briefly on the emergence of ideas about the makeability (‘Machbarkeit’)¹⁴⁵ of the world and the human, linking technology, education and progress in the 18th century, and how technologisation proceeded further in economy, science and education.

In Section 3, we characterise the current phase of technologisation from the perspective of environmental care and social progress. In particular, we problematise how the different policies and solutions consider the contradictions and tensions between the Global North and the Global South. Furthermore, we comment on how they relate to adult, vocational and higher education. By describing an example from Bangladesh, we intend to show alternatives for the Global South from the Global South.

¹⁴³ for ex. Kothari, A., Salleh, A., Escobar, A., Demaria, F., Acosta, A. (eds.) (2019). *Pluriverse - A post-development dictionary*. New Delhi: Tulika books; Lessenich, St. (2016): *Neben uns die Sintflut. Die Externalisierungsgesellschaft und ihr Preis*. Berlin: Hanser Verlag; Hickel J., Dorninger, C., Wieland, H., Suwandi, I. (2022). Imperialist appropriation in the world economy: Drain from the global South through unequal exchange, 1990–2015. *Global Environmental Change* (73). <https://doi.org/10.1016/j.gloenvcha.2022.102467>

¹⁴⁴ See chapter 2 by Lassnigg, L. and chapter 3 by Jinia, N. J. et al in this publication.

¹⁴⁵ We intentionally use the word ‘makeability’, since it better corresponds to the meaning indicated originally in German and Finnish than for ex. ‘malleability’ or ‘doability’ in English.

In the concluding section, we argue that technological ethos has become the spirit of current global capitalism. Technologisation, together with capitalism, necessarily led to the exploitation of human and nonhuman environments, with its exceptionalist human values and governance. While technological ethos characterises the anthropocentric human self-comprehension, reflections on its connection to ‘environmental care’, ‘development’ and ‘progress’ must go beyond the impact assessment of technology (Technologiebewertung, Technikfolgenabschätzung) or the power of technological judgement (technologische Urteilskraft). The search for alternatives in adult, vocational and higher education requires historical and philosophical analysis about their contribution to technologisation from the integrative perspective of humans and other earthlings.

Technology and the Makeability of the World and Humans

While ‘technique’ can be attributed to any good human or nonhuman performance, technology can be characterised as the application of (scientific) knowledge to manipulate human and nonhuman environments for certain human purposes.¹⁴⁶ Our main focus is on *technologisation of the economic sphere* – production, consumption, distribution – which relates to the transformation of work, occupations and industry and how it was directly promoted by education. A parallel technologisation process took place in social, political and educational spheres, operating at system, institutional and individual scales. We are aware of the highly gendered quality of technologisation, but due to lack of space, we are not able to address the topic here. In the following, keeping in mind the problems of environmental care and social progress and the constitution of the Global North and the Global South, we first discuss the ‘spirit of technology’ as governance of nature and the creation of artificial ‘nature’ in economy and industry, with its direct impacts on education. Second, we discuss technologisation as the governance of political, social and psychic phenomena and the simultaneous fragmentation and standardisation of life and education. Third, we refer to an earlier critique on technologisation, which is still relevant for current reflections.

Technologisation of Work and Education

It can be argued that technologisation emerged together with the increasingly complex and hierarchical division of work (i.e. occupations),

¹⁴⁶Ropohl, G. (1979): *Eine Systemtheorie der Technik. Zur Grundlegung der Allgemeinen Technologie*. München, Wien; Ahlman, E. (1939). *Kulttuurinperustekijöitä*. (Foundations of culture) Jyväskylä: Gummerus.

the triumph of capitalist economy and the exploitation of human and nonhuman nature – such as energy, raw materials, animals and plants.¹⁴⁷ Among the key ambitions of technological expansion were the substitution, compensation and extension of human capacities.¹⁴⁸ In the European history of ideas and thinking, this process was justified by humanist ideals about freeing humans from their natural conditions of reproduction and suggesting liberation of humans from evolutionary pressures, unlike other creatures. Humans also ‘liberated’ – domesticated and exploited – masses of other creatures from evolutionary pressure to make them serve their own liberation towards more advanced and higher functions of humanity.

The emergence of the era of technologisation may be traced to the intellectual agendas of early Enlightenment thinkers in 17th century Europe, such as Francis Bacon in England and René Descartes in France. They propagated geometry and revelation of laws of nature through empirical research as the foundations for rational comprehension of reality and as the means for humankind to govern nature and to continuously improve the lives of individuals and societies. However, for both, the ideals of good life, guiding science and technology, were ultimately to be found in the Christian religion, in God’s words.¹⁴⁹ The initiatives of scientific and technical education around Europe were justified by religious ideas of humans as self-perfectible images of God (‘*imago Dei*’), who are able to progress to higher levels of humanness. The ideas built on assumptions about hierarchies in the potential of people to express humanness, depending on culture, race and gender, which legitimised the progress of technologisation of work and education hand in hand with the conquest and colonisation of the planet.¹⁵⁰ This implied

¹⁴⁷Ropohl, G. (1991). *Technologische Aufklärung. Beiträge zur Technikphilosophie*. Frankfurt am Main: Suhrkamp; Steffen et al 2015; Moore, J. W. (2017a). The Capitalocene Part II: accumulation by appropriation and the centrality of unpaid work/energy. *The Journal of Peasant Studies*. <https://doi.org/10.1080/03066150.2016.1272587>

¹⁴⁸Ropohl (1979); Euler, P. (1999). *Technologie und Urteilskraft. Zur Neufassung des Bildungsbegriffs*. Weinheim: Deutscher Studien Verlag.

¹⁴⁹Böhme, G. (1993). *Am Ende des Baconschen Zeitalters*. Frankfurt am Main: Suhrkamp; Von Wright, G. (1987). *Tiede ja ihmisjärki*. (Science and human reason) Helsinki: Otava.

¹⁵⁰ There is no space here to discuss the intertwinement of technologization with warfare, militarism and violence, though this would be most critical for its ethical analysis.

the formation of the Global North through accelerating capitalist appropriation and exploitation of its human and nonhuman resources.¹⁵¹

The scientification of education in the Global North has progressed since the 18th century. During this period, attempts to govern experiential and contextual practices began through the institutionalization of theoretical and empirical theories, concepts and methodologies. This was integrated into the expansion of industrial capitalism and systems of governance. The thinkers and politicians of pedagogical enlightenment in German-speaking countries emphasised the disenchantment of the world, which encouraged the transformation of divine and natural orders into systems and aims designed and controlled by human knowledge and techniques. In the strive towards ideal humanness and culture, religious imageries were transcended, and conservative traditions were replaced by science-based shaping of human and nonhuman reality through pedagogy and technology. Since then, technological, economic and social progress, human well-being and self-realisation have been ever-increasing, detached from natural evolution.¹⁵² Despite close contacts with German-speaking countries, Finnish and other Nordic scholars and politicians translated their intellectual and economic agendas into their own versions, connecting utilitarianism and pragmatism to folk edification and nation-building.¹⁵³

The institutionalisation of technology as a discipline and as engineering professions was connected and justified by the progress of mechanical industry, capitalist economy and liberal democracy – especially in the form of free labour force. The promotion of progress implied the mission for planning, forecasting and experimenting in industry, economy and society. The theories and models of mathematics – descriptive geometry in the first place – and natural sciences were translated into applied scientific foundations for different fields of technology; laboratories and

¹⁵¹ Böhme (1993); Moore (2017a).

¹⁵² Ropohl (1991); Euler (1999); Wascher, U. (1988). *Spurensicherung: Polytechnik: zur Geschichte eines Begriffes*. Bad Honnef: Bock und Herchen. Schriften zur Berufspädagogik und Arbeitslehre; Bd. 17.

¹⁵³ Heikkinen, A. (1995). *Lähtökohtia ammattikasvatuksen kulttuuriseen tarkasteluun. Esimerkinä suomalaisen ammattikasvatuksen muotoutuminen käsityön ja teollisuuden alalla 1840–1940*. (Startingpoints to cultural reflections on vocational education) Tampere: Tampere University Press; Harju, A., Heikkinen, A. (2017). *Adult Education and the Planetary Condition*. Helsinki: VST. SVV-programme. <https://urn.fi/URN:ISBN:978-952-5349-27-6>

experiments were required for testing and modelling technical innovations.¹⁵⁴

Fragmentation of Life and Education

Technologisation, linked with capitalisation and urbanisation, promoted the differentiation of livelihoods, industries and work, leading to an expansion of occupational and social hierarchies in leading industrial capitalist countries, such as Germany, during the 19th century. Societal and individual life fragmented into different spheres and phases, such as privacy and family, social and political publicity, and work and economy. However, until the early 20th century, the Finnish economy functioned rather as the 'Global South', a provider of cheap labour and raw materials for global and colonial capitalism. It relied primarily on self-sustainable rural industries and on the export of raw materials, though technologisation was encouraged by the needs of the Russian markets. However, the emergence of technological sciences led to a fundamental transformation in conceptions of work, industry and education for work, impacting all sectors of industry, organisation and management of work and society. The adoption of the idea about the makeability and control of the world through technical artefacts and technological steering became necessary but also extended into makeability and control of societal and individual life.

Technologisation and capitalisation enforced horizontal and hierarchical division of work and the vanishing of previous (pre-technical) industries and communities. Despite differences in the formation of education in relation to technologisation, vocational education for shop floor employees, supervisors and managers became increasingly separated from higher technical education for directors and designers and from emerging forms of political and academic folk edification and academic education for public and private sector professionals.¹⁵⁵

The idea of the makeability of the world and humanity, along with an affinity for technologisation, gained prominence in education due to the advancement of empirical and applied psychology since the turn of the

¹⁵⁴Ropohl 1979; Michelsen, K.-E. (1999). *Viides sääty. Insinöörit suomalaisessa yhteiskunnassa*. (The fifth estate: engineers in Finnish society) Helsinki: TEK&SHS.

¹⁵⁵ Greinert, W.-D. (2003). *Realistische Bildung in Deutschland. Ihre Geschichte und ihre aktuelle Bedeutung*. Hohengehren: Schneider Verlag; Blankertz, H. (1969). *Bildung im Zeitalter der großen Industrie: Pädagogik, Schule und Berufsbildung im 19. Jahrhundert*. Hannover etc.: Schroedel; Heikkinen (1995).

20th century. In German-speaking and Nordic countries, psychotechnical theories and methods were adapted in all industries to intensify work performance and learning.¹⁵⁶ Techno-scientific management was required to adjust the ‘human machinery’ to the nonhuman machinery. Simultaneously, technocratic ideas about the effective governance of societies emerged, promoting social sciences and economics and their technologisation. Technological experts gained growing influence in policymaking and administration.¹⁵⁷ Following the reconstruction period after World War II, a major shift towards the planning and social engineering of societies and the world system took place. Since the 1940s, supranational agencies such as the UN, OEEC (OECD), GATT (World Bank), IMF, and ECTC (EU) have been established. In Germany and Finland, national planning and reform policies have been implemented to promote scientific-technological progress (‘revolution’) in all sectors, together with supporting welfare systems since the 1960s.

The separation between the forms and functions of education was institutionalised. Technology – technological knowledge production and innovation – had gained a firm status as a distinctive academic discipline but was also influencing all other disciplines and standardising reforms in the academy. The function of vocational education as the subsumption of workers into servants of the techno-industrial machinery was also institutionalised in the widening sector of vocational adult education and human resource development. General education, as well as popular adult education institutions, became increasingly responsible for the socialisation of the population into subordinates of techno-industrial capitalist societies. Nevertheless, they were still justified with the concept of ‘Bildung’ as idealising humanity/humanness, alongside the promise of equality of opportunity in the ‘highly developed’ Global North.¹⁵⁸

Critical Reflections on Technologisation in the Global North

The process of technologisation has faced criticism in various forms, including vocational, adult and higher education. Although since the turn of the 20th century, modernist art celebrated technologisation,

¹⁵⁶ Berner, E. (2015): Vocational Education and Training in the Early 20th Century. In Molzberger, G., Wahle, M. (Hg.). *Shaping the futures of (vocational) education and work. Commitment of VET and VET research* (pp. 33–53). Wien: Peter Lang; Heikkinen (1995); Kettunen, P. (1994). *Suojelu, suoritus, subjekti: työsuojelu teollistuvan Suomen yhteiskunnallisissa ajattelu- ja toimintatavoissa*. (Protection, performance, subject: industrial safety in societal ways of thinking and acting in industrializing Finland) Helsinki: SKS.

¹⁵⁷Ropohl (1979); Michelsen (1999).

¹⁵⁸ Greinert (2003); Ropohl (1991); Harju et al (2015)

industrialisation and urbanisation both in Germany and Finland, insightful critique emerged outside the academy, though not without academic influence. Influential examples in the film industry, paradoxically enabled by technological advancement, were *Metropolis*, a science-fiction film directed by Fritz Lang (1926), and *Modern Times*, a black comedy directed by Charles Chaplin (1936). (see Figure 1). They presented allegories and prophecies about the intertwining of capitalist economy, oppression and alienation of workers, urbanisation and technologisation in the Global North.

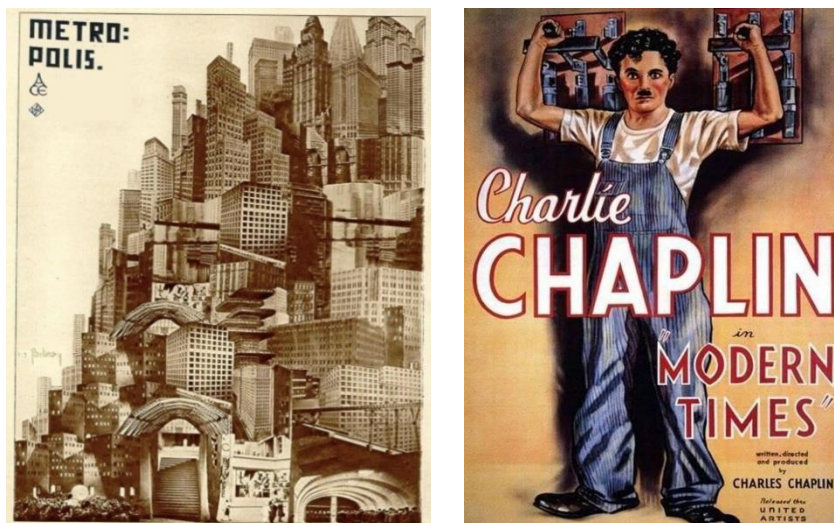


Figure 1: Posters from *Metropolis*¹⁵⁹ and *Modern Times*.¹⁶⁰

Neither of the films directly refers to education, but they indicate occupational, organisational and societal hierarchies justified by education.¹⁶¹ The managers and scientific and technical designers of technologised industry and society rule and control both its machinery and machinists: workers. The films show the psychotechnical function of vocational and adult education in disciplining and shaping employees to adapt to the technologised capitalist order. However, the anthropogenic

¹⁵⁹[https://en.wikipedia.org/wiki/Metropolis_\(1927_film\)](https://en.wikipedia.org/wiki/Metropolis_(1927_film))

¹⁶⁰[https://en.wikipedia.org/wiki/Modern_Times_\(film\)](https://en.wikipedia.org/wiki/Modern_Times_(film))

¹⁶¹ Molzberger, G. (2020). Utopisch? Betrachtungen zur Weiterbildung in einer digitalisierten Arbeitswelt durch die Linse dreier Darstellungen aus dem sciencefiction Genre. In Buchmann, U. & Cleef, M. (Eds.). *Digitalisierung über berufliche Bildung gestalten* (pp.71–80). Bielefeld: Wbv.

and artificial realms of the films seem totally autarkic, without any metabolic relation with nonhuman nature: in *Metropolis*, 'nature' either presents an existential threat to techno-city or an amusement park for the elite; in *Modern Times*, 'nature' only looms as an amorphous opportunity for anarchic escape.

An example of a holistic academic critique is Spanish philosopher Ortega y Gasset, who considered technology to evolve through phases from 'ancient' (natural) technology through mediaeval craft or artisan technology towards 'modern' technology of the technician. He analysed the mission of modern technology and science as releasing a space for humans as 'extra-natural beings' with their infinite passion for more pleasure and well-being.¹⁶² He emphasises the paradoxical impact of the pre-established, systematic, methodical way of thinking and of the unlimited possibilities of technology on human culture. While technology provides exceptional opportunities for good life or well-being, it also hides its natural and human conditions. Therefore, education on these conditions and pretechnical humanness would be necessary, especially for engineers, who are the manifestations of technology.

The phases Ortega described have also been considered to emerge parallel. Hannah Arendt¹⁶³ analysed the transformation of Western ways of human life ('societies') according to relations between labour (*Arbeit*), work as production (*Herstellen*) and action (*Handeln*). She emphasises how industrialised production overcame work and craft, separating technicians from labourers, and started to replace the sphere of political action. This leads to the loss of the 'pretechnical' foundation of human life. However, Arendt considers that the separation and tension between labour, work and action is continuing and always present in human societies.

In Finland, philosophical anthropologist and educational philosopher Erik Ahlman¹⁶⁴ analysed technologisation critically as a triumph of instrumental values and mechanisation in Western cultures. He was concerned that education is becoming increasingly a servant for technology. In particular, for German scholars, the consequences of the industrial, economic, political and educational technologisation of the fascist regime triggered wide and thorough criticism of technologisation,

¹⁶² Ortega y Gasset, J. (1939). *Man the Technician*. In Ortega y Gasset, J. (1941). *Toward A Philosophy of History*. NY: W. W. Norton & Co.

¹⁶³ Arendt, H. (1967). *Vita Activa - oder vom tätigen Leben*. München: Piper.

¹⁶⁴ Ahlman (1939).

which they considered the upshot of the Enlightenment. Most exemplary are Max Horkheimer and Theodor Adorno, who developed their reflections about the dialectics of scientific knowledge and technologies in the USA during their exile from National Socialist Germany.¹⁶⁵ In 1947, they argued that since the Enlightenment and the suspension of the dignity of nature, scientific knowledge has by no means only made humans masters of nature but has also led to the subjection of nature and humans to the knowledge of rules and technologies produced by humans. According to Horkheimer and Adorno, modern, technologised society and its institutions already contain the germ of retrogression. Therefore, modern society needs to reflect on this retrograde moment.¹⁶⁶

Despite the neo-humanist critique of technologisation, the separation of vocational and technical education from academic and higher education and adult education continued in post-World War II Germany, strengthening their function to reproduce the horizontal and vertical occupational structures. In Finland, the transition to a technocratic planning society during the 1960s was accompanied by the Nordic ideal of equality of opportunity. It implied the implementation of the comprehensive principle in compulsory education, but the fragmentation of vocational, adult and academic (higher) education prevailed. The few critical voices that also showed how technologisation included alienation from and increasing degradation of human and nonhuman nature¹⁶⁷ did not stop its increasing domination in educational policy. It was considered a critical condition for social and economic progress in both Germany and Finland.

Technological ‘Progress’ and Imposing it on the Global South

The Promise of Economic, Social and Political Progress through Technologisation

Technologisation has expanded globally through the stabilisation of the science–technology–capitalist industry nexus.¹⁶⁸ This was at the heart of imposing hegemonic knowledge, governance and education regimes and hierarchies into colonised areas of the planet. The current *geological era*

¹⁶⁵“Dialectics of the Enlightenment” appeared in 1947 – after the monstrous experience of a machinery for the systematic destruction of humans.

¹⁶⁶ Horkheimer, M., Adorno, T. W. (1947). *Dialektik der Aufklärung*. Amsterdam: Querido Verlag N.V.

¹⁶⁷ Blankertz, H. (1964): Die Menschlichkeit der Technik. In *Westermanns pädagogische Beiträge* 10, 451–460; von Wright (1987).

¹⁶⁸ von Wright (1987); Ropohl (1991); Moore (2017a).

is characterised as the Anthropocene, where human activity has become the dominant influence on the earth system and the environment.¹⁶⁹ The human-caused climate change as well as the nuclear meltdown in Chernobyl and Fukushima are striking examples of the dialectic of technological progress, suggested by Horkheimer and Adorno. However, by questioning the universalist guilt of humankind, the *historical era* can also be called the Capitalocene.¹⁷⁰ Thus, the changes in the earth system are understood as expressions of gradual capitalogenic change since 15th-century Europe. According to Moore, capitalism is a way of organising ‘nature’ to accumulate capital by the appropriation of work/energy. Capitalocene builds on four Cheaps of ‘nature’: food, labour power, energy and raw materials. Key features of this process include extractivism, productivism and consumerism.

Extractivism means that the progress of the Capitalocene requires technologies that constantly expand the kinds and quantities of nonhuman resources – minerals, plants, animals. The greenwashing of industries and energy production – electrification of vehicles, growing capacity and speed of digital tools, solar and wind power machineries, artificial production of foodstuff, textiles, etc. – depends on extracting ever-new raw materials for machines, processes and logistics. *Productivism* indicates that the criterion for economic growth is increasing productivity, achieved by the continuous increase of products and by intensifying the production process through new technological innovations and more efficient use of labour. *Consumerism* is linked to productivism since economic growth requires constant growth in consumption and an ever-increasing interest in new commodities to consume.¹⁷¹

¹⁶⁹ Steffen et al (2015).

¹⁷⁰ Moore (2017a); Moore, J. W. (2022). Anthropocene, Capitalocene& the Flight from World History. *Nordia Geographical Publications* 51(2); Chandler, D., Cudworth, E., & Hobden, S. (2018). Anthropocene, Capitalocene and Liberal Cosmopolitan IR: A Response to Burke et al.’s ‘Planet Politics.’ *Millennium*, 46(2), 190–208. <https://doi.org/10.1177/0305829817715247>

¹⁷¹ Moore (2017a); Moore (2022); Kothari et al (2019); Pereira, C., Tsikata, D. (2021). Contextualising Extractivism in Africa. *Feminist Africa* 2 (1), 14-48 https://feministafrica.net/wp-content/uploads/2021/04/fa_v2_issue1_Feature-article-Contextualising-Extractivism-in-Africa.pdf; Hickel J. (2019). The contradiction of the sustainable development goals: Growth versus ecology on a finite planet. *Sustainable Development*, (27)5, 873–884. <https://doi.org/10.1002/sd.1947>

Currently, the hegemonic version of technologisation seems to be part of the *ecomodernist or green growth/transition* agenda. It is widely adopted by national and supra-national agencies affiliated with the United Nations Sustainable Development Goals.¹⁷² The major trends of technologisation emerging from the Global North are *digitalisation, renewable energy, and a circular economy*.

In Germany and Finland, the term ‘Industry 4.0’ has spread widely with other buzzwords like ‘industrial internet of things’, ‘artificial intelligence’ and ‘digitisation’. It did not fall from heaven but was introduced in Germany at an industrial trade fair in Hannover in 2011.¹⁷³ It was part of an agenda towards leadership in competition in the high-tech industry, joining economy, science and politics, and has been promoted through the World Economic Forum since 2016.¹⁷⁴ Industry 4.0 refers to former industrial revolutions, such as the invention of the steam engine in the late 19th century, the conveyor belt as an electrical innovation in the early 20th century and automatisisation since the introduction of computers. Proponents of Industry 4.0 consider it a new phase in the science–capitalist industry–technology nexus, characterised by comprehensive, intelligent cyber-physical systems. Green production would also contribute to environmental sustainability. The numbering suggests a constant progression of technologisation. However, it also

¹⁷² An Ecomodernist Manifesto (2015). Retrieved 2.09.2022 from <http://www.ecomodernism.org/>; World Bank (n.d.). Focus: Sustainable Development Goals. Retrieved 27.10.2022 from <https://openknowledge.worldbank.org/pages/sustainable-development-goals>; European Commission (2015). Closing the loop - An EU action plan for the Circular Economy. COM/2015/0614 final. <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1452152692467&uri=CELEX:52015DC0614>; European Commission (2019). Delivering the European Green Deal. https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en; OECD (2016), Policy Guidance on Resource Efficiency, OECD Publishing, Paris, <https://doi.org/10.1787/9789264257344-en>; United Nations (UN 2016). Transforming our World: The 2030 Agenda for Sustainable Development. <https://digitallibrary.un.org/record/1654217>

¹⁷³ Pfeiffer, S. (2017). The Vision of “Industrie 4.0” in the Making—a Case of Future Told, Tamed, and Traded. *Nanoethics* 11(1), 107–121. <https://doi.org/10.1007/s11569-016-0280-3>

¹⁷⁴ VDI nachrichten (2011). Industrie 4.0: Mit dem Internet der Dinge auf dem Weg zur 4. industriellen Revolution. <http://www.vdi-nachrichten.com/artikel/Industrie-4-0-Mit-dem-Internet-der-Dinge-auf-dem-Weg-zur-4-industriellen-Revolution/52570/1>

hides its fundamental, environmentally destructive effects, delegating them to the assessment of technological impact.

An example of the internal contradiction of technological progress is the celebration of the utmost costly, extractivist and energy-exploiting technologies through *quantum computing*. According to the Finnish VTT (state technological research centre), a quantum computer is ‘a device that makes possible the impossible’.¹⁷⁵ Quantum technologies are assumed critical for the leap towards Industry 4.0 and holistic implementation of intelligent or knowledge societies. From the perspective of the Global South, the advancements in quantum technology seem weird, while most countries lack even stable and functioning electric and internet connections.

The leaders of politics, industry and science configure Finland and Germany as forerunners in the global shift towards renewable, ‘green’ and ‘pure’ energy, such as solar, wind and bioenergy. The closing of the era of the ‘fossil-economy’ is dependent on high-tech solutions and digitalisation. However, only the elites of the Global North possess the required financial and natural resources and qualified labour force since the current technological solutions cannot be upscaled to the Global South, which continues to be the target of appropriation of human and nonhuman resources by the Global North.¹⁷⁶

The spearhead of global eco-modernist and green growth policies is the ‘*circular economy*’ through high-tech innovations and utilising green/pure energy.¹⁷⁷ This should reduce ‘industrial metabolism’ – the converse of energy and materials in industrial processes – and allow recycling and ecologically effective production, consumption and distribution. However, the agenda forgets that the majority of humankind

¹⁷⁵Heima, T-P. (2020, November 16). "Mahdollottoman mahdolliseksi tekevä laite" – Näin VTT:n johtaja kuvailee Suomeen tulevaa kvanttitietokonetta. *Yle*.
<https://yle.fi/a/3-11649407>

¹⁷⁶ Hickel et al (2022).

¹⁷⁷ Standing Committee of the National People's Congress (2008). Circular Economy Promotion Law of the People's Republic of China. <http://www.lawinfochina.com/display.aspx?id=7025&lib=law>; UN (2015), OECD (2016), EC (2015); BMUV (2020). Kreislaufwirtschaftsgesetz. Gesetz zur Förderung der Kreislaufwirtschaft und Sicherung der umweltverträglichen Bewirtschaftung von Abfällen. <https://www.bmu.de/gesetz/kreislaufwirtschaftsgesetz>; Sitra (2016). Leading the cycle – Finnish road map to a circular economy 2016–2025. <https://www.sitra.fi/app/uploads/2017/02/Selvityksia121.pdf>

has, for most of its history, adapted its ways of life and economy to the nonhuman environment. This has meant keeping the material and energy flows as closed as possible instead of committing to the doomed ‘linear economy’ of fossil fuels.¹⁷⁸ The circular economy promises to continue economic growth and increase wealth and well-being without degrading the environment. While the promise is false due to physical reasons (no artefacts or organisations can emerge or sustain without feeding external energy and raw materials), it factually also fosters productivism and consumerism.

Most fundamental examples of malfunctioning social metabolism – reproduction of a social system through energy and material flows from nature and other social systems¹⁷⁹ – and alienated relations of humans to nonhuman nature come from *agriculture, animal husbandry* and *forestry*. They have become globally dependent on chemical and biological technology – especially on fertiliser and pesticide production of companies in the Global North. In Finland, a paradoxical situation has emerged when felling forest for fields is subsidised in order to store the manure from animal husbandry. While animal husbandry was originally important to gain manure for more productive agriculture, the problem of utilising manure as a fertiliser has remained technologically unsolved, undermining efforts to diminish the ecological footprint of animal husbandry. Furthermore, the social metabolism and the environmental burden of agricultural communities in the Global North are enormously higher than those in the Global South, which rely more directly and profoundly on human labour and simple techniques.¹⁸⁰ Despite limitations in data about the totality of the carbon emissions, pollution and exploitation of ‘natural resources’, the available information shows that the actual environmental burden and ecological footprint of the Global North is largely externalised and delegated to the Global South.¹⁸¹

The ecomodernist and green growth agendas continue to value nonhuman nature as ecosystem services and nature capital as natural resources and reservoirs for capitalogenic economic growth and increasing productivity. They do not recognise it as ‘nature work’ and

¹⁷⁸ Haas, W., Andarge, H. B. (2017). More Energy and Less Work, but New Crises: How the Societal Metabolism-Labour Nexus Changes from Agrarian to Industrial Societies. *Sustainability* 2017 9(7); Kothari et al (2019)

¹⁷⁹ for ex Haas et al (2017).

¹⁸⁰ Haas et al (2017); Kothari et al (2019).

¹⁸¹ Global Footprint Network (n.d.). Advancing the Science of Sustainability. <https://www.footprintnetwork.org/>. Retrieved 15.7.2022; Lessenich (2016).

‘nature economy’, as part of earth work and economy (‘oikos’), where human work, industry and economy are embedded.¹⁸² In highly technologised communities, the metabolic interaction of humans with other humans and the nonhuman environment becomes totally mediated by technological artefacts and systems, leading to the blindness of their interconnectedness. In less technologically mediated contexts, humans are able to directly experience and become better aware of the quality of their metabolic interaction with nonhuman nature.

The recommendations of the UN on *environmental or sustainability education* have since the 1980s been widely included in education policies and national curricula for compulsory education, but their implementation into vocational, adult and higher education has been much slower. Although, for example, the UN SDGs have recently been adopted into their strategies, the promotion of technologisation in education and through educational technology has continuously sped up.¹⁸³ Both in Germany and Finland, the focus in adult, vocational and higher education policies seems to be in ‘sustainable’ consumer behaviour and in the acquisition of skills and competencies for ‘green industries’ and in advancing educational technology. Critique of technologisation or initiatives for alternative forms of work, industry and economy are not encouraged. Environmental education still primarily focuses on raising awareness of children and youth, with minor interest in mobilising students and learners in vocational, adult and higher education to search for alternatives in work, economy and politics.¹⁸⁴

Imposing the Technological Gospel to the Global South

¹⁸² Moore (2017a).

¹⁸³ Strietska-Ilina, O., Mahmud, T. (eds.) (2019). Skills for a greener future: A global view based on 32 country studies. International Labour Office – Geneva: ILO; OECD (2021). Think green: Education and climate change. *Trends Shaping Education Spotlights 24*. OECD Publishing, Paris, <https://doi.org/10.1787/2a9a1cdd-en>

¹⁸⁴ Finnish Government (2021). Education Policy report of the Finnish Government. <http://urn.fi/URN:ISBN:978-952-383-927-4>; The Ministry of Education and Culture (n.d.). The National Roadmap for Research, Development and Innovation. Retrieved January 1, 2023 from <https://okm.fi/en/rdi-roadmap>; BMUV (2020); Heikkinen, A.; Sorsa, S.; Xing, X.; Li, Q.; Cheng, J.; Tan, L.; Kalimasi, P.; Kilasa, N.; Wadende, P.; Oyaro, E.; Opwonya, N. (2022). Mediators for sustainable livelihoods : Promoting sustainable livelihoods in vocational and adult education through university curricula and programs. <https://trepo.tuni.fi/handle/10024/142591>; Ruuska, T. (2017). Reproduction of capitalism in the 21st century: higher education and ecological crisis. Aalto University. <https://aaltodoc.aalto.fi/handle/123456789/26627>

The policies tackling global environmental and human crises continue the intertwined agenda of technological and social progress, building on diagnoses and solutions that are suitable for the Global North. However, the allegories and prophecies envisioned in *Metropolis* and *Modern Times* continue to be realities in the Global South. The eco-modernist and green growth visions and strategies promoted by global governance offer lists of good intentions without problematising the historical inequalities and power relations conditioning their potential at various places on the planet.¹⁸⁵ Consequently, the actors controlling global market capitalism with its commodity chains – primarily in the Global North, but also in the South – are privileged in defining the technological solutions and social progress of sustainable development. Within both the Global North and Global South, the opportunities for claiming alternatives are limited due to the dependency of potentially opposing groups on the dominant economic, technological and political elites.¹⁸⁶

The relevance of technological solutions originating from the Global North should be questioned because of the differences in production, consumption and externalisation of environmental burdens between places. Global interdependencies and power relations between national economies favour the North at the cost of the South despite their internal diversity.¹⁸⁷ In the Global North, technologisation and global economic inequalities have led to exponential growth in the value and consumption of products and services (‘national wealth’), although the growth of domestic use of resources is stabilising. On the other hand, the levels of wealth, domestic use of resources, technologisation, and use of fossil fuels have continued to remain low in the Global South.¹⁸⁸ In the ecomodernist and green growth agendas, technologisation is intertwined with the growth of economy, productivity and well-being. Therefore, the alternative agendas and movements primarily critique the unfair division of economic growth and environmental burden between the Global North and Global South.

The *degrowth agenda* primarily garners support from the Global North, while the environmental justice agenda, which shares some affinity with

¹⁸⁵ Eco-modernist Manifesto (2015); EU (2015); EU (2019); OECD (2016); UN (2016).

¹⁸⁶ Pereira et al (2021); Hickel (2019).

¹⁸⁷ Hickel et al (2022).

¹⁸⁸ Collste, D., Cornell, S., Randers, J., Rockström, J., & Stoknes, P. (2021). Human well-being in the Anthropocene: Limits to growth. *Global Sustainability* 4(E30). <https://doi.org/10.1017/sus.2021.26>; Görg et al (2020).

UN SDGs, tends to find supporters from the Global South.¹⁸⁹ Proponents of degrowth consider the long-lasting capitalogenic appropriation of human and nonhuman nature as the root cause of environmental degradation, intertwined with social and human crises. They find radical reduction in the use of energy and materials – and thus productivity and consumption – the only way to combat the collapse of the earth system. Even considering the UN SDGs, it has been shown that, on average, the well-being measured by SDGs has not increased since the 1960s or 1970s despite an exponential increase in incomes and consumption.¹⁹⁰ Although proponents of degrowth consider economic growth and social progress as slogans that justify and accelerate technologisation, their suggestions for the future are primarily political and economic – ‘deaccumulation’, ‘decommodification’, ‘decolonisation’ of human and nonhuman resources. The notions about a simpler life typically connect to promises of increasing equality, justice and ‘nonmaterial’ well-being but are silent required changes in human work and technology.¹⁹¹

The *environmental justice agenda* emphasises fairness in the use of natural resources between and within the Global North and Global South. It considers multinational corporations responsible for the environmental damage in the Global South but is also critical to top-down, large-scale programmes imposed by supranational organisations, dominated by the Global North.¹⁹² The proponents of environmental justice remind us about the low social metabolism of local, indigenous solutions in the economy, but they also emphasise collective ownership and local democracy, which

¹⁸⁹ Akbulut et al (2019); Rodríguez-Labajos, B., Yáñezc, I., Bond, P., Greyle, L., Mungutif, S., UyiOjog, G., Overbeek, W. (2019 March). Not So Natural an Alliance? Degrowth and Environmental Justice Movements in the Global South. *Ecological Economics* 157, 175–184. <https://www.sciencedirect.com/science/article/pii/S0921800918307626?via%3Dihub>

¹⁹⁰ for ex. Collste et al (2021).

¹⁹¹ Akbulut, B., Demaria, F., Gerber, J.-F., Martínez-Alier, J. (2019). Who promotes sustainability? Five theses on the relationships between the degrowth and the environmental justice movements. *Ecological Economics* 165. <https://doi.org/10.1016/j.ecolecon.2019.106418>.; Kothari et al (2019); Hickel (2019).

¹⁹² Rodríguez-Labajos et al (2019); Kothari (2019).

allow ‘fair extraction, distribution and disposal of materials and energy across the members of a given society’.¹⁹³

Although degrowth and environmental justice agendas may be converging, the suggestions from the Global South about local and collective, low-metabolic work and production still seem marginally recognised as alternatives to technologisation. Nevertheless, they might remind us of the possibility of less-metabolic, more locally controlled and collective livelihoods in the Global North as well, which were subdued by technological and social progress and a capitalogenic economy. Concerning vocational, adult and higher education, it also reminds us of the intertwining of technologisation and division of work between the Global North and Global South. Despite mainstream rhetoric of sustainable development, the traditional servant role of education in promoting colonisation and technological import has radically strengthened through the global education industry with its taken-for-granted assumption of inferiority and backwardness of skills, competencies and educational solutions in the Global South. In their competition for technological superiority, the traders of education confirm the continuity of the belief in superior humanness among representatives of the Global North.

Technologisation, Environmental Care and Inclusive Well-being in the Global South: Example from Bangladesh

Bangladesh in South Asia is a striking example of the capitalogenic process dominated by the Global North, of the long appropriation of its human and nonhuman resources and of the exploitative global division of work and industries. During the British era, the human and nonhuman environment were moulded to enhance the industrialisation and economic growth of the coloniser.¹⁹⁴ While leading to economic, technological and education dependency, colonialist structures continued to characterise the industrial and economic position of Bangladesh as a provider of cheap nature, energy, food and labour, suffering from environmental degradation, pollution, social inequality, instability and poverty. Being one of the most densely populated countries in the world, confronted by a massive refuge of Rohingya people from Myanmar, it is one of the most vulnerable to climate change in the world. Therefore, inclusive well-being

¹⁹³ Akbulut et al (2019); Quilley, S., Hawreliak, J., Kish, K. (2017). Finding an Alternate Route: Towards Open, Eco-cyclical, and Distributed Production. *The Journal of Peer Production*, 10/24/2017, 9.

¹⁹⁴ Schendel, W. v. (2020). *The History of Bangladesh*. Cambridge University Press.

is crucial for ensuring that economic growth and development are equitable and beneficial to all members of society.

Currently, Bangladesh aims at breakthroughs to reach sustainable development goals by 2030 in terms of policy and strategy. However, there is increasing evidence about the contradictions of UN SDGs and environmental care, especially concerning relations between the Global North and Global South, and due to the hegemonic role of supranational agencies – such as the World Bank – in controlling their implementation. Due to the emphasis on the global aggregate growth of GDP, countries like Bangladesh are pressed to prioritise economic growth and extractivist industries, while their servient role in global trade and economy prevails.¹⁹⁵ Eco-modernist policies ignore the social and political implications of technological solutions. While they assume that they will be accessible and affordable to everyone, this is not the case in countries such as Bangladesh. In fact, they may increase inequality because those who can afford the latest technology will have an advantage over those who cannot. On the other hand, de-growth ideas and values, imposed by the Global North, about reducing consumption of resources and promoting sustainability, ignore that Bangladesh represents neo-colonialism in the Global South. It has contributed marginally to environmental degradation at the planetary scale but is most vulnerable to the effects. However, the Global North, which is mainly responsible, is promoting the use of their technology to address the problem in the Global South.

While the downscaling of abstract lists of global targets without concrete implementation plans and ‘hardware’ of governance and institutions have failed, environmentally wise solutions in economy and industry require collaboration between governments, local stakeholders (especially NGOs and private sectors), research communities and education.¹⁹⁶ Bangladesh is striving towards climate resilience with the support of non-governmental operations, but they suffer because local governments lack independence from the control and bureaucracy of the central government, as well as resources, knowledge and capacity.¹⁹⁷

¹⁹⁵ Hickel (2019), (2022), Pereira et al (2021).

¹⁹⁶ Heikkinen et al (2022); Moallemi, E.A., Malekpour, S., Hadjidakou, M., Raven, R., Szetey, K., Ningrum, D., Dhiaulhaq, A., Bryan, B. A. (2020). Achieving the Sustainable Development Goals Requires Transdisciplinary Innovation at the Local Scale. *One Earth* 3(3). <https://doi.org/10.1016/j.oneear.2020.08.006>

¹⁹⁷ Alam, SM, S. (2016). *Strategic Institutional Capacity in Solid Waste Management: The Cases of Dhaka North and South City Corporation in*

NGOs already have local networks that contribute to disaster relief, democracy building, conflict mediation, human rights work, cultural preservation, environmental advocacy, policy formulation, research and information sharing. The opportunities for local stakeholders, communities and educators to act are paradoxically constrained due to digital technology, which is considered to promote good governance and democracy in the Global North.¹⁹⁸ In Bangladesh, as in numerous countries across the Global South, digital security acts (such as the DSA in 2018) have led to surveillance and repression of citizens in cyberspace. Authorities, ruling parties and the police have employed the DSA to stifle media and curtail freedom of expression by harassing and indefinitely detaining journalists, activists and other government critics, creating a chilling effect on the expression of dissent.¹⁹⁹

The technologisation of vocational, adult and higher education in the Global North is considered the key driver of economic growth and sustainable development, but imposing such educational models on different socio-cultural, political and economic contexts, such as Bangladesh, is doomed to fail. Instead, it creates a dependence on imported products and materials, leading to a neglect of traditional knowledge and local practices of society. Although technological and social solutions from the Global North may not be feasible and scalable in the Global South, countries like Bangladesh may be in greatest need of technological innovations, which would both reduce their environmental burdens and improve well-being.²⁰⁰ The concept of a circular economy might be feasible if growth and prosperity were to be defined more broadly than economic growth. If the circular techniques of traditional industries, which have deteriorated in the Global South,²⁰¹ would be recognised, it could have immense potential for environmentally sound economic solutions. In Bangladesh, a socio-culturally, politically and economically localised concept of circularity could imply a ‘circular

Bangladesh. Acta Universitatis Tamperensis.

<https://trepo.tuni.fi/handle/10024/99921?show=full>

¹⁹⁸ See chapter 8 by Wallén, B. in this publication.

¹⁹⁹ Human Rights Watch (2022). *Human Rights World Report 2022: Bangladesh.*

<https://www.hrw.org/world-report/2022/country-chapters/bangladesh>

²⁰⁰ Schroeder, P., KartikaAnggraeni, K., Weber, U. (2018, February 13). The Relevance of Circular Economy Practices to the Sustainable Development Goals. *Journal of Industrial Ecology* 23(9). <https://doi.org/10.1111/jiec.12732>

²⁰¹ Martinez-Alier, J. (2021). The circularity gap and the growth of world

movements for environmental justice. *Academia Letters*, Article 334. <https://doi.org/10.20935/AL334>

society', which integrates the circular economy with the perspectives of local people, considering their livelihood, equality and human development. Local circular society would consist of waste and circular citizenship and network in community, creation of circular entrepreneurship for local actions, and circular microcredits for local entrepreneurs.

Towards Ethics of care for Human and Nonhuman Environments

Ethos of Technologisation

It seems that technologisation has become a religion-kind of 'ethics of the spirit of capitalism' emanating from the Global North. The exceptionalism of humans – their humanness – compared to other species and nonhuman beings builds on technology, i.e. exploitation of 'cheap' energy and material of human and nonhuman nature. The calculative, instrumental and objectifying approach to human and nonhuman environments joins technology with a capitalist economy, whose ultimate aim is the accumulation of capital.

The dominant notion of *progress* in the Global North relates to the Christian religion and the Calvinist doctrine of predestination, which may have functioned as the superstructure of rising Western capitalism.²⁰² In the aspiration to belong to the chosen people, who are meant to strive towards *imago Dei*, success and progress on earth were considered signs of being elected for heaven instead of the netherworld. Christian God had created humans to become his images and had given them the earth to govern and exploit. Since God was almighty – governing and controlling everything – ideal humanness meant becoming able to govern and control the human and nonhuman world. In the strive for God-like humanness, the spirit of technologisation has progressed by making earth comprehensively anthropocentric and presenting itself as secular.²⁰³ In the belief that the salvation of the earth (*Gaia*) would be in the hands of humans, the idea continues in green growth or eco-modernist solutions to the environmental crisis. Comprehensive technologisation, especially with digitised governance and artificial intelligence, can elevate technological systems to almost God-like entities. However, to ensure the functionality and effectiveness of these systems, humans need to invest increasing resources in learning, maintaining, and serving them.

The rhetoric of technology being just instrumental for the implementation and application of other ethical and moral purposes

²⁰² von Wright (1987); Ropohl (1991); Böhme (1993).

²⁰³ Ahlman (1939); von Wright (1987); Fischer, P. (1996). Zur Genealogie der Technikphilosophie. In Fischer, P. (Hg.) *Technikphilosophie*. Leipzig: Reclam.

sounds fundamentally opportunist. The progress promised by technologisation requires prioritisation of values and virtues, which justify it in all spheres of life. It has become the moral and ethical standard for other values, such as justice and the common good. Earlier critics warned about the increasing alienation of humans from themselves and nonhuman nature in work and social interaction. However, in the current phase of technologisation and capitalism, the scale of individual and collective metabolic alienation has grown gigantic despite differences between the Global North and the Global South. The earlier critique focused on the evaluation of the impact and consequences of technology and on developing technological judgement capacity, which might turn the process progressive – increasing good and decreasing harm – both for human and nonhuman environments. It belittled, however, the essence of the technologisation process where ‘technological means’ have become ‘ends’, which drive the innovation of ever-new technologies.

Although our notions about the ethos of technologisation emphasise the economy and industry, it cannot be separated from politics. Technological and economic ‘progress’ are linked with power struggles, class conflicts, wars and violence among humans and nonhumans. The ethos of technologisation seems to dominate different layers of politics and governance, which focus on promoting technological change and finding technological solutions to overcome its ‘unintended’ consequences. Technologisation is fundamentally about the *division and hierarchisation of work* among humans and nonhumans, but negotiations between the latter are implicit or absent. Therefore, humans holding economic and political power in the Global North are responsible for compensating for the historical injustice and harms caused by the capitalogenicttechnologisation process. Revising the social metabolism–labour–work regime implies that the exploitation of seemingly ‘cheap’ human and nonhuman work should be reduced, and human-centred energy and material flows and extraction should be minimised. Humans should narrow the use of energy and material to maintain themselves for the ‘common good’ of the whole ‘environment’, assemblages of human and nonhuman earthlings. Decent lowering of social metabolism would imply a profound simplification of technology, governance and education in the Global North.

Technical Values and Virtues in Vocational, Adult and Higher Education

The question about the role of adult, vocational and higher education in tackling technologisation is fundamentally a concern about the dialectic between environmental action and consciousness (‘Sein und

Bewusstsein’).²⁰⁴ Paradoxically, the awakening of humans and their potential to halt and turn the anthropogenic condition of the earth system builds on findings and outcomes from (natural) sciences and technology and their integration with the capitalist economies and societies of the Global North. From a secular, scientific perspective, the transformation of the universe and planet Earth does not follow anthropocentric ethical principles and values, such as doing good or justice. Therefore, paradoxically, *only human beings can take the ethical responsibility* for ‘compensating’ the harm of environmental degradation, earth-economic inequalities and injustices caused among human and nonhuman earthlings.

Recognition of the ‘ecological debt’ for the degradation of the earth economy, industry and work during the Capitalocene requires deconstruction of the technological setup of ‘progress’ and ‘development’ in the Global North. In education, this implies unlearning ‘progressive’ values and virtues, competencies and skills oriented to capital accumulation and competition in the appropriation of ‘nature’. Instead of the currently fashionable agendas of ‘restoration of nature’ together with the acceleration of urbanisation, centralisation and green technology, addressing the ‘ecological debt’ means more than awareness raising through ‘eco-social education’ and tagging educational activities according to their response to the UN SDG targets. Unlearning requires concrete *alternativetechniques* for material action. What would this mean in vocational, adult and higher education in Germany, Finland and Bangladesh?

In order to create alternatives to technologisation as ethos and ways of life, educationalists should analyse the values and virtues it promotes and figure alternatives for them. Instead of striving for their ‘good life’ or ‘well-being’, should humans learn to be satisfied with a reasonable – good enough – life among themselves and nonhumans and promote modesty, humility and respect towards the *nonhuman environment*? Since human economies and societies are embedded in the earth economy and assemblages of earthlings, could *technique* as human virtue be interpreted as the most modest social metabolism possible in the context of earthly metabolism? This would lead to simpler ways of life, which build on knowledge and understanding of interdependencies between earthlings locally and across localities.²⁰⁵

²⁰⁴ See chapter 5 by Ahmad A. F. & Asaduzzaman M. and chapter 7 by Peltonen H. in this publication.

²⁰⁵ There is no space here to discuss, whether gradual deconstruction of the technologization process questions ‘eudaimonia’/‘wellbeing’/‘good life’ as a basic

Since the unsustainable social metabolism depends on political economy (or ecology), critical genealogical analyses are needed between the Global North and Global South about how education has contributed to capitalogeniotechnologisation of human–nonhuman assemblages locally and across localities. They may also reveal lost, demolished and forgotten solutions with lower social metabolism, which should be recalled and could function as examples for a gradual deconstruction of the layers of technologisation. As the case of Bangladesh highlights, colonial history, vulnerability to climate change and economic dependence on the Global North shape most countries in the Global South. Therefore, addressing such complexities requires collaboration among stakeholders and acknowledging their socio-cultural, political and economic history. While the imposition of foreign educational models should be avoided, promoting contextually appropriate technological innovations and localised concepts of circularity in vocational, adult and higher education can contribute to environmental care and inclusive well-being in the Global South.

The history of educational and governing actions and institutions has been about shaping human minds and behaviour by using their authority. While psychological and moral development extends throughout the life course, analyses and interpretations should reach beyond childhood and youth.²⁰⁶ The educational ideal of awareness and the ability of humans to become more knowledgeable and able to make a change could be interpreted as release from and resistance or critique to technologisation in education and governance locally, nationally and planetarily. It questions the self-deceiving and escapist expectation and assumption that children and youth would start to think and behave – adopt values and virtues – which would enable radically alternative ways of life among human and nonhuman earthlings. Nevertheless, different cohorts of adults may continue to commit to their earlier values and practise their previous ways of life and virtues.²⁰⁷ The critical reflections on technologisation enforce understanding of the concept and ideal of wisdom²⁰⁸ as responsiveness – ability to be responsive – of adult humans

ethical value and virtue. Tentatively, like technologization has beside promised ‘social progress’ led to unintended maladies, its deconstruction might lead to unintended ‘goodness’ among various kinds of earthlings.

²⁰⁶ See chapter 6 by Kallio, E. K. in this publication.

²⁰⁷ Swyngedouw, E. (2022). The unbearable lightness of climate populism. *Environmental Politics*, 31(5), 904–992.
<https://doi.org/10.1080/09644016.2022.2090636>

²⁰⁸ See chapter 6 by Kallio, E. K. in this publication.

to develop ‘practical reason’ by learning together with nonhumans and their wisdom.

The ‘progress’ towards care for human and nonhuman environments cannot rely on moral education, which only emphasises mental values, virtues and cognition. A social metabolism and way of life, which is adjusted to earth metabolism and existential rights of other earthlings, requires radical material changes in work, production, consumption and distribution, in industrial and trade relations, and in social interaction and political practices. To function, i.e. to be manageable for humans, solutions should be small and local enough. Understanding earth-political and earth-economic ‘citizenship’²⁰⁹ may require closer integration, if not fusion, of different forms of education. The perspective of nonhuman earthlings should be included in the aims and functions of education, such as participation in bodies and creation of knowledge, participation in occupationally divided work life, participation in societally organised social life, and actualisation of unique ‘personhood’.²¹⁰ We assume that the change requires a parallel shift in individual and collective *consciousness* (values, knowledge) and *action* (behaviour, performance).²¹¹ As unique planetary institutions in knowledge creation and in the education of leaders and professionals, universities have a distinctive moral obligation to collaborate with vocational and adult educators in inventing techniques of environmental care, which would minimise social metabolism and respect the historical wisdom of diverse local livelihoods.²¹² Adult, vocational and higher education must undergo a profound transformation to address the heritage of technologisation. This entails shifting values, embracing sustainable practices and fostering critical analyses.

²⁰⁹ See chapter 8 by Wallén, B. in this publication.

²¹⁰ Heikkinen, A. (2018). Ammattisivistyksen lupaus antroposeenin/kapitaloseenin aikakaudella. (The promise of vocational edification in the era of Anthropocene/Capitalocene. In J. Tähtinen, J. Hilpelä & R. Ikonen. *Sivistys ja kasvatus eilen ja tänään*, 56 (pp. 305–328). Kasvatuksen ja koulutuksen historian tutkimusseura. <https://journal.fi/koulujamenneisyys/article/view/77700/38703>

²¹¹ See chapter 7 by Peltonen, H. in this publication.

²¹²cf. Heikkinen et al (2022).