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Item 6 of the provisional agenda*

MAINSTREAMING BIODIVERSITY INTO THE MANUFACTURING AND PROCESSING INDUSTRY: AN INITIAL COMPILATION OF REFERENCE DOCUMENTS, DATA AND KEY ACTORS

Note by the Executive Secretary

1, In decision XIII/3, paragraph 109, the Conference of the Parties decided to consider at its fourteenth meeting the mainstreaming of biodiversity into the sectors of energy and mining, infrastructure, manufacturing and processing, and health. To assist the Secretariat in preparing the foundation for these discussions, the Executive Secretary has commissioned, with the financial support from the European Union, an external consultant on the relationship between biodiversity and the manufacturing and processing sector. The Executive Secretary is circulating herewith, for the information of participants in the twenty-first meeting of the Subsidiary Body on Scientific, Technical and Technological Advice, a document entitled "Mainstreaming biodiversity in the manufacturing and processing sector - an initial compilation of reference documents, data and key actors", as it was received by the Secretariat.

2. The document provides information regarding the definition of the manufacturing and processing sectors, global status and trends in the manufacturing and processing sector, interactions between manufacturing and biodiversity, and approaches to mainstreaming biodiversity in the manufacturing and processing sector. It is presented under agenda item 6 on mainstreaming of biodiversity into the sectors of energy and mining, infrastructure, manufacturing and processing industry, and health: scientific and technical considerations and use of the programmes of work of the Convention.

* CBD/SBSTTA/21/1.

MAINSTREAMING BIODIVERSITY IN THE MANUFACTURING AND PROCESSING SECTOR

Deliverable 2: An initial compilation of reference documents, data and key actors

November 10, 2017

Report to the

Secretariat of the Convention n Biological Diversity

by

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1. DEFINING THE MANUFACTURING AND PROCESSING SECTORS

According to the United Nations Statistics Division (UNSD)'s International Standard Industrial Classification of All Economic Activities[1], manufacturing "*includes the physical or chemical transformation of materials, substances, or components into new products*." Included in this definition are (a) units (plants, factories or mills) that typically use power-driven machines and materials-handling equipment, (b) units that transform materials or substances into new products by hand or in the worker's home and (c) businesses that sell directly to the general public their products made on the same premises from which they are sold (e.g., bakeries and custom tailors). The output of a manufacturing process may be:

- Finished, i.e. ready for utilization or consumption, or
- Semi-finished, i.e. can become an input for further manufacturing.

The UNSD classifies manufacturing industries (section C) into the following divisions:

- 10 - Manufacture of food products;
- 11 - Manufacture of beverages;
- 12 - Manufacture of tobacco products;
- 13 - Manufacture of textiles;
- 14 - Manufacture of wearing apparel;
- 15 - Manufacture of leather and related products;
- 16 - Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials;
- 17 - Manufacture of paper and paper products;
- 18 - Printing and reproduction of recorded media;
- 19 - Manufacture of coke and refined petroleum products;
- 20 - Manufacture of chemicals and chemical products;
- 21 - Manufacture of basic pharmaceutical products and pharmaceutical preparations;
- 22 - Manufacture of rubber and plastics products;

[1] United Nations Statistics Division (2017). International Standard Industrial Classification of All Economic Activities, Rev.4. https://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=27

- 23 - Manufacture of other non-metallic mineral products;
- 24 - Manufacture of basic metals;
- 25 - Manufacture of fabricated metal products, except machinery and equipment;
- 26 - Manufacture of computer, electronic and optical products;
- 27 - Manufacture of electrical equipment;
- 28 - Manufacture of machinery and equipment n.e.c.;
- 29 - Manufacture of motor vehicles, trailers and semi-trailers;
- 30 - Manufacture of other transport equipment;
- 31 - Manufacture of furniture;
- 32 - Other manufacturing;
- 33 - Repair and installation of machinery and equipment.

NB: This classification of manufacturing industries excludes some activities which sometimes involving transformation processes and are classified in other sections of ISIC, such as logging, classified in section A (Agriculture, forestry and fishing) and the beneficiation of ores and other minerals, classified in section B (Mining and quarrying).

2. GLOBAL STATUS AND TRENDS IN THE MANUFACTURING SECTOR

According to the World Bank[2], manufacturing accounted for approximately 15% of global GDP in 2016 (Table 1), with some disparities across regions (e.g., lower percentage for low income nations on average).

Table 1: The contributions of agriculture, industry, manufacturing and services to Gross Domestic Product worldwide

	Gross domestic $ billions 2016	Agriculture % of GDP 2016	Industry % of GDP 2016	Manufacturing % of GDP 2016	Services % of GDP 2016
World	75,543.5	4	27	15	69
East Asia & Pacific	22,477.4	5	34	..	60
Europe & Central Asia	20,162.9	2	26	16	72
Latin America & Caribbean	5,201.2	6	26	14	68
Middle East & North Africa	3,111.5	7	38	..	53
North America	20,104.9	1	20	12	79
South Asia	2,896.4	18	28	16	54
Sub-Saharan Africa	1,498.0	18	24	10	58
Low income	405.5	30	22	8	48
Lower middle income	6,252.2	17	30	16	53
Upper middle income	20,477.5	7	34	..	59
High income	48,407.6	1	24	15	74

According to the International Labour Organization (ILO)[3], manufacturing accounted for 23% of total employment worldwide in 2012. It was then projected to account for 24% of total employment worldwide by 2018.

Moreover, the characteristics (e.g., research and development intensity, labour intensity, energy intensity) of industries within the manufacturing sector vary greatly, so that industries can be grouped into five categories according to McKinsey (2012)[4] (Table 2): i.e., global innovation for local markets (34% of global manufacturing value

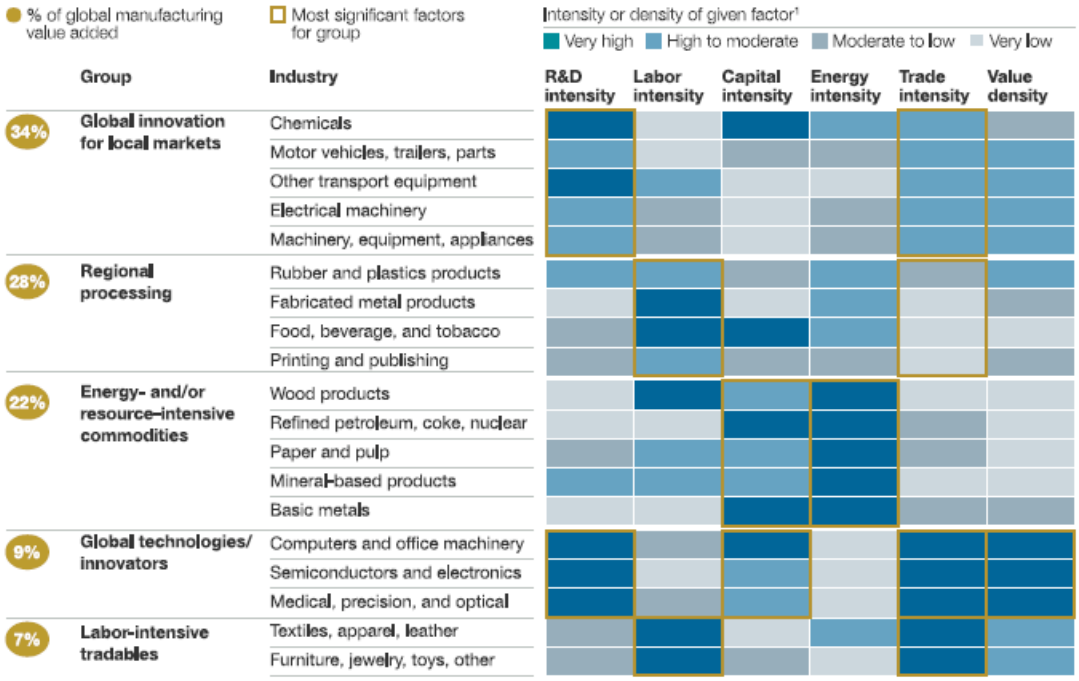
[2] URL: http://wdi.worldbank.org/table/4.2#, accessed on November 9, 2017.

[3] URL: http://www.ilo.org/global/research/global-reports/global-employment-trends/2014/WCMS_234879/lang--en/index.htm, accessed on November 9, 2017.

[4] McKinsey (2012). Manufacturing the future: The next era of global growth and innovation. URL: https://www.mckinsey.com/business-functions/operations/our-insights/the-future-of-manufacturing, accessed on November 7, 2017.

added), regional processing (28% of global manufacturing value added), energy and/or resource intensive commodities (22% of global manufacturing value added), global technologies / innovators (9% of global manufacturing value added) and labour intensive tradable (7% of global manufacturing value added).

Table 2: Five key industry groups within the manufacturing sector according to six characteristics / needs (McKinsey 2012)



Recently, global economic growth has been weak (UNCTAD 2016[5]), growing at a rate below 2.5 per cent, and global trade slowed down dramatically to around 1.5 per cent in 2015 and 2016, compared to 7 per cent before the crisis. While global value chains (GVCs) remain concentrated among a relatively small number of countries, the manufacturing sector is looking for growth opportunities, by notably putting significant investment into research and development and new markets (e.g., KPMG

[5] UNCTAD (2016). The Trade and Development Report (TDR) 2016. URL: http://unctad.org/en/pages/PublicationWebflyer.aspx?publicationid=1610, accessed on November 9, 2017.

International's 2016 Global Manufacturing Outlook[6]). According to UNIDO (2013[7]; 2017[8]), the megatrends affecting the "advanced manufacturing"[9] industries include:

- Continuing ageing of the workforce in some developed countries, which is expected to challenge lifestyles and consumption patterns as well as to diminish the size of the available workforce for manufacturing;
- Changing manufacturing skills needs, which, combined with ageing populations, is already leading to a shortage of qualified manufacturing labour in some regions;
- Growing demand for customised products and services according to consumers' individual specifications is becoming critical for market and value capture for companies around the world;
- Increasing demand for manufactured goods in cities, notably in the context of growing demand for urban mobility, energy, housing and telecommunication solutions;
- Growing interest in industrial and technological strategies by governments across both emerging and high-wage economies;
- Increased efforts to support reshoring to developed countries, as a potential strategy to expand the domestic manufacturing base and foster high-wage job creation, innovation and exports.

In addition, according to Hallward-Driemeier and Naygar (2018), The Internet of Things (IoT), advanced robotics, and 3-D printing are shifting the criteria that make locations attractive for production and are threatening significant disruptions in employment, particularly for low-skilled labor[10].

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[6] URL: https://home.kpmg.com/xx/en/home/campaigns/2016/05/kpmg-internationals-2016-global-manufacturing-outlook-competing-for-growth.html, accessed on November 7, 2017.

[7] López-Gómez, C., O'Sullivan, E., Gregory, M., Fleury, A., Gomes, L. (2013). Emerging Trends in Global Manufacturing Industries. United Nations Industrial Development Organization.

[8] López-Gómez, C., Leal-Ayala, D., Palladino, M., O'Sullivan, E. (2017). Emerging trends in global advanced manufacturing: Challenges, opportunities and policy responses. United Nations Industrial Development Organization.

[9] Advanced manufacturing technology is defined as computer-controlled or micro-electronics-based equipment used in the design, manufacture or handling of a product. OECD Frascati Manual, Sixth edition, 2012; URL: https://stats.oecd.org/glossary/detail.asp?ID=52, accessed November 9, 2017.

[10] Hallward-Driemeier, M., Nayyar, G. (2018). Trouble in the Making? The Future of Manufacturing-Led Development. Washington, DC: World Bank. doi:10.1596/978-1-4648-1174-6.

3. MANUFACTURING AND BIODIVERSITY: WHAT INTERACTIONS?

All businesses both depend and impact, directly and indirectly, on natural capital stocks (including biodiversity; Figure 1) and the associated ecosystem services (Hanson *et al*., 2012[11]; Houdet *et al*., 2012[12]; TEEB 2012[13]). Yet, such interactions do not all have the same consequences as natural capital stocks are divided into renewable and non-renewable assets: While metals and minerals are non-renewable natural capital assets (e.g. coal) whose exploitation can only lead to their eventual depletion, renewable natural capital assets, such as water resources and populations of species, can (theoretically) be sustainably managed in perpetuity (i.e., concept of sustainable use of biodiversity).

Figure 1: Natural capital / biodiversity, ecosystem and abiotic services and benefits to business and to society (Natural capital Coalition 2016)[14]

This inter-dependency between business and natural capital creates costs and benefits for business and society, generating risks but also creating opportunities (Figure 2). Natural capital impacts and/or dependencies can directly affect business operations, which can generate positive (e.g., lower input costs) or negative effects

[11] Hanson, C., Ranganathan, J., Iceland, C., Finisdore, J. (2012). The corporate ecosystem services review: Guidelines for identifying business risks and opportunities arising from ecosystem change. World Resources Institute, Washington, DC, Version 2.0 (of same authors and report name from 2008).
[12] Houdet, J., Trommetter, M., Weber, J. (2012). Understanding changes in business strategies regarding biodiversity and ecosystem services. Ecological Economics 73: 37-46.
[13] TEEB (2012). The Economics of Ecosystems and Biodiversity in Business and Enterprise. Edited by Joshua Bishop. Earthscan, London and New York.
[14] Natural Capital Coalition (2016). Natural Capital Protocol. (Online) Available at: www.naturalcapitalcoalition.org/protocol, accessed November 9, 2017

(e.g., discontinued supply of raw materials, water shortages) (Natural Capital Coalition 2016[15]). Simultaneously, these impacts / dependencies can also positively (e.g., improved water quantity and quality due to business' efforts to sustainably manage its watershed) or negatively (e.g., air emissions) impact on particular stakeholders or on society as a whole. Eventually, stakeholder and societal responses to these effects can create additional risks and opportunities to businesses.

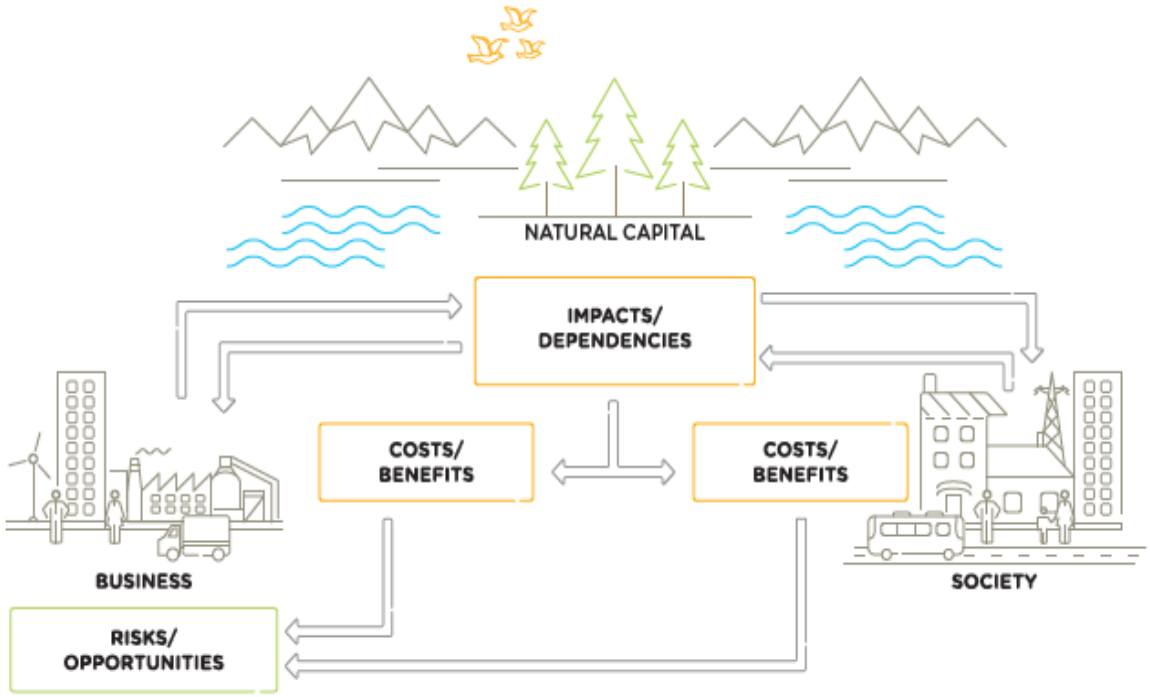

Figure 2: Conceptual model between business and natural capital - dependencies and impacts, costs and benefits, risks and opportunities (Natural Capital Coalition 2016)[16]

As illustrated in Table 3, the impacts and dependencies on ecosystem services vary across industries, with the manufacturing sector linked primarily to direct and indirect impacts and dependencies on most provisioning services and some regulating services. What's more, such interactions may vary across space (e.g., different ecosystems allow for different ecosystem uses or impacts) and will be influenced by existing policy / regulatory environments and social norms as well as power relationships amongst stakeholders.

[15] Ibid 14.
[16] Ibid 14.

From the perspective of business dependencies on provisioning services, some manufacturers rely directly on the supply of renewable, biological raw materials (e.g., fibres, foods), while others use genetic resources and associated traditional knowledge, including the pharmaceutical, agriculture, industrial biotechnology, cosmetics, botanicals, and food and beverage sectors[17,18]. From the perspective of business dependencies on regulating services, the relationship is less direct, linked to the various ecosystem processes that enable the production of key inputs into manufacturing processes (e.g., water regulation and purification in crop farming).

Table 3: Impacts and dependencies of different industries on ecosystem services (WBCSD 2011)[19]

	Biodiversity dependent industries (e.g. fishing, agriculture, forestry)		Large 'footprint' industries (e.g. mining, oil and gas, construction)		Manufacturing & processing (e.g. chemicals, ICT, consumer products)		'Green' enterprises (e.g. organic farming, ecotourism)		Financial services (e.g. banking, insurance & other financial intermediaries)	
Key Ecosystem Services	*DEPEND*	*IMPACT*	*DEPEND*	*IMPACT*	*DEPEND*	*IMPACT*	*DEPEND*	*IMPACT*	*DEPEND*	*IMPACT*
Provisioning										
Food	●	●	○	●	●	●	●	○	●	●
Timber & fibers	●	●	●	●	●	●	●	○	●	●
Freshwater	●	●	●	●	●	●	●	○	●	●
Genetic / Pharmaceutical resources	●	●	○	○	●	●	●	○	●	●
Regulating										
Climate & air quality regulation	●	●	●	●	●	●	●	○	●	●
Water regulation & purification	●	●	●	●	●	●	●	○	●	●
Pollination	●	●	-	○	○	○	●	●	●	●
Natural hazard regulation	●	●	●	○	●	○	●	○	●	●
Cultural										
Recreation & tourism	○	●	-	●	-	○	●	●	●	●
Aesthetic / non-use values	○	●	-	●	-	○	●	●	○	●
Spiritual values	○	●	-	●	-	○	●	●	○	●

● *Moderate to Major relevance* ○ *Minor relevance* - *Not relevant (typically)*

[17] A series of briefs and factsheets on these sectors have been prepared by the Secretariat in the Series "Bioscience at a Crossroads"; URL: https://www.cbd.int/abs/resources/factsheets.shtml; accessed on November 9, 2017.

[18] "BioTrade" refers to those activities of collection, production, transformation, and commercialization of goods and services derived from native biodiversity under the criteria of environmental, social and economic sustainability. The revenue in 2012 for bio-trade companies was US$ 5.2 million; however, the market potential is estimated by UNCTAD at US$ 141 billion,18 representing an opportunity for small and medium-sized enterprises to contribute to biodiversity conservation as well as job creation.

[19] World Business Council on Sustainable Development (WBCSD), 2011. Guide to corporate ecosystem valuation. A framework for improving corporate decision-making, 76p.

From an impact perspective, manufacturers have also direct and indirect impacts on ecosystems. Table 4 provides an illustration of various impact drivers that are applicable to the manufacturing sector, through their direct operations and/or indirectly through the value chain of their products (e.g., raw materials extraction or production, client / consumer use phase, end-of-life).

Table 4: Examples of natural capital impact drivers linked to business inputs and outputs (Natural Capital Coalition 2016)[20]

Business input or output	Impact driver category	Examples of specific, measurable impact drivers
Inputs	Water use	Volume of groundwater consumed, volume of surface water consumed, etc.
	Terrestrial ecosystem use	Area of agriculture by type, area of forest plantation by type, area of open cast mine by type, etc.
	Fresh water ecosystem use	Area of wetland, ponds, lakes, streams, rivers or peatland necessary to provide ecosystem services such as water purification, fish spawning etc., areas of infrastructure necessary to use rivers and lakes such as bridges, dams and flood barriers, etc.
	Marine ecosystem use	Area of aquaculture by type, area of seabed mining by type, etc.
	Other resource use	Volume of mineral extracted, volume of wild-caught mammals by species, etc.
Outputs	GHG emissions	Volume of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulphur hexafluoride (SF_6), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs), etc.
	Non-GHG air pollutants	Volume of fine particulate matter ($PM_{2.5}$) and course particulate matter (PM_{10}), volatile organic compounds (VOCs), mono-nitrogen oxides (NO and NO_2, commonly referred to as NO_2), sulphur dioxide (SO_2), carbon monoxide (CO), etc.
	Water pollutants	Volume discharged to receiving water body of nutrients (e.g., nitrates and phosphates) or other substances (e.g., heavy metals and chemicals).
	Soil pollutants	Volume of water matter discharged and retained in soil over a given period.
	Solid waste	Volume of waste by classification (i.e., non-hazardous, hazardous and radioactive), by specific material constituents (e.g., lead, plastic), or by disposal method (e.g., landfill, incineration, recycling, specialist processing).
	Disturbances	Decibels and duration of noise, lumens and duration of light etc., at site of impact.

In other words, manufacturing-related dependencies and impacts on biodiversity occur not only at the level of direct operations (i.e., the actual manufacturing industries as defined by the UNSD), but also throughout their supply chains and the use / end-of-

[20] Ibid 14.

life of the products they manufacture (e.g., the impacts and dependencies on natural capital of barley used to produce beer; Figure 3).

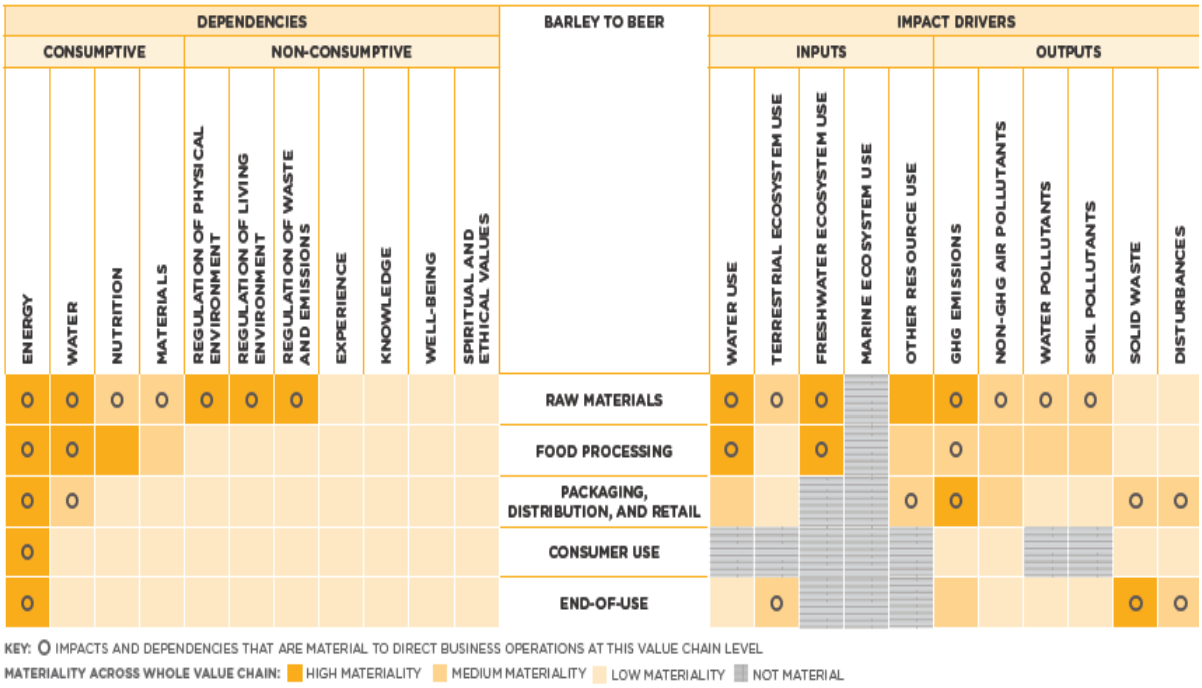

Figure 3: Indicative materiality matrix for the value chain of barley used to produce beer[21]

As currently configured, manufacturing has a large material impact on ecosystems and human health (UNEP 2011)[22]. Manufacturing is responsible for around 35 per cent of global electricity use, over 20% of CO_2 emissions and over a quarter of primary resource extraction. It also accounts for up to 17 per cent of air pollution-related health damage. Estimates of gross air pollution damage range from 1 to 5 per cent of global Gross Domestic Product (GDP). Water use by industry is expected to grow to over 20 per cent of global total demand by 2030 (UNEP 2011)[23].

However, identifying the industries within the manufacturing sector that have the greatest potential impact on biodiversity at the global, regional and national levels can be challenging, notably due to the global nature of supply chains but also the spatial

[21] Natural Capital Coalition (2016b). Natural Capital Protocol – Food and Beverage Sector Guide. (Online) Available at: www.naturalcapitalcoalition.org/protocol, accessed November 7, 2017.
[22] UNEP (2011). Manufacturing: Investing in energy and resource efficiency.
[23] Ibid 21.

and temporal distribution of biodiversity. In addition, most current resources focus on impact drivers[24] (e.g., air emissions, water use) not impacts[25] (e.g., decrease in population of a species, % loss of a specific habitat / vegetation type) per se, which all contribute to the challenge of matching specific manufacturing industries with the loss of specific biodiversity attributes.

Nevertheless, there are resources which can help identify the industries with the biggest proportions of impact drivers / impacts, including for instance:

- For the for the manufacturing sector in general: e.g., UNIDO resources (URL: https://www.unido.org/what-we-do/environment.html), UNCTAD resources (e.g., http://unctad.org/en/Pages/DITC/Trade-and-Environment.aspx); US Environmental Protection Agency regulatory information on manufacturing (URL: https://www.epa.gov/regulatory-information-sector/naics-sectors-31-33-manufacturing),
- For the textile industry: e.g., EU funded research reports (URL: http://susproc.jrc.ec.europa.eu/textiles/docs/120423%20IMPRO%20Textiles_Publication%20draft%20v1.pdf; http://ec.europa.eu/eurostat/documents/3217494/5723037/KS-32-10-283-EN.PDF/22a4889d-e6c9-4583-8d17-fb5104e7eec0), Kering Environmental Profit & Loss Statements (e.g., http://www.kering.com/en/sustainability/results), IUCN resources (e.g., https://portals.iucn.org/library/sites/library/files/documents/Rep-2016-001.pdf), various research / scientific outputs (e.g., http://www.esm.ucsb.edu/research/2014Group_Projects/documents/Biodiversity_FINAL_brief.pdf);
- For the manufacture of furniture: e.g., FAO (URL: http://www.fao.org/docrep/004/Y3609E/y3609e07.htm), various guidance / resource documents and websites (e.g., https://dnr.mo.gov/pubs/pub1183.pdf http://www.p2pays.org/iso/business/furnaiassess.asp);

[24] Impact driver: An impact driver is defined here a measurable quantity of a natural resource that is used as an input to production (for example, volume of sand and gravel used in construction) or a measurable non-product output of business activity (for example, a kilogram of NOx emissions released into the atmosphere by a manufacturing facility). Ibid 13.

[25] Natural capital impact are the negative or positive effect of business activity on natural capital. It involves changes in natural capital (e.g., decrease in the population of a plant species is a negative impact of land use change / habitat transformation which are impact drivers).

- For the manufacture of rubber and plastics products: e.g., various guidance documents and websites, notably from the finance sector (http://www.netregs.org.uk/business-sectors/rubber-and-plastic-products/; http://www.ebrd.com/downloads/policies/environmental/chemical/rubber-products.pdf; http://www.ifc.org/wps/wcm/connect/0749ef004885566dba04fa6a6515bb18/Final+-+Metal,+Plastic,+and+Rubber+Products+Mnfg.pdf?MOD=AJPERES; https://www1.toronto.ca/city_of_toronto/toronto_public_health/healthy_public_policy/chemtrac/industries/files/pdf/greenplasticsrubber.pdf).
- For the manufacture of chemicals and chemical products: e.g., resources of the Strategic Approach to International Chemicals Management (SAICM) (URL: http://www.saicm.org/About/SAICMOverview/tabid/5522/language/en-US/Default.aspx).

4. MAINSTREAMING BIODIVERSITY IN THE MANUFACTURING SECTOR: WHAT APPROACHES?

Biodiversity mainstreaming refers to the process of embedding biodiversity considerations into policies, strategies and practices of key public and private actors that impact or rely on biodiversity, so that it is conserved and sustainably used both locally and globally[26]. Under the CBD, the theme of mainstreaming biodiversity is supported by Article 6, subsection b, which states that each party "*integrate, as far as possible and as appropriate, the conservation and sustainable use of biodiversity in plans, programs and sectoral and intersectoral policies*"; as well as in Article 10, subsection a, which calls on the parties to "*integrate, as far as possible and as appropriate the conservation and sustainable use of biological resources into national decision-making*."[27] This practically involves explicitly integrating renewable natural capital considerations into organisational/business, sectoral and/or cross-sectoral (e.g., IIED and UNEP-WCMC 2014[28]; Secretariat of the Convention on Biological Diversity 2011[29]):

- Legislations, regulations, standards, and guidelines;
- Policy documents;
- Strategies, plans and program of actions;
- Action plans and budgets;
- Service delivery and/or production processes; and
- Performance indicators, monitoring and reporting systems.

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[26] For instance, for the Global Environmental Facility, biodiversity mainstreaming focuses primarily on "*the following activities (i) developing policy and regulatory frameworks that remove perverse subsidies and provide incentives for biodiversity-positive land and resource use that remains productive but that does not degrade biodiversity, (ii) spatial and land-use planning to ensure that land and resources are used appropriately to maximize production without undermining or degrading biodiversity; and (iii) improving and changing production practices to be more biodiversity-positive with a focus on sectors that have significant biodiversity impacts such as agriculture, forestry, fisheries, tourism, and extractives*." Accessed on November 26, 2017; URL: https://www.thegef.org/news/un-biodiversity-conference-cop13-mainstreaming-biodiversity-well-being

[27] Accessed on November 26, 2017; URL: http://cop13.mx/en/mainstreaming-biodiversity/

[28] IIED, UNEP – WCMC, 2014. Mainstreaming biodiversity and development: Discussion Paper. NBSAPs 2.0: Mainstreaming Biodiversity and Development project, 68p.

[29] Secretariat of the Convention on Biological Diversity, 2011. NBSAP training modules version 2.1 – Module 3. Mainstreaming biodiversity into national sectoral and cross-sectoral strategies, policies, plans and programs. Montreal, 39p.

Yet, additional research is needed for cost-effective mainstreaming, notably with respect to the following questions:

- Which manufacturing industries have the most impacts on biodiversity? What are the associated practices and impact drivers?
- Which ones have the biggest dependencies on biodiversity?
-
- what are the concrete positive examples as well as challenges in the private sector and in countries in addressing biodiversity and Mfg?

Given the nature of interactions between manufacturing and biodiversity (see section 3 above), the effective mainstreaming of biodiversity would involve mainstreaming activities and tools at each step of the value chain of products manufactured, from the production / extraction of raw materials upstream to the end-of-life of goods and services. Such activities / tools may be industry specific (e.g., specific pollution or emissions standards for different manufacturing processes) or have broader scopes, such as (but limited to):

- Using various valuation approaches to improve corporate and public decision-making (e.g., e.g., Diaz *et al*., 2015[30] ; Gómez-Baggethun *et al*., 2014[31]; Houdet and Chikozho, 2015[32]; Natural Capital Coalition 2016[33]; TEEB 2012[34]);
- Corporate social responsibility (e.g., Smit 2014[35]);
- Mandatory and voluntary disclosure / reporting (e.g., KPMG 2016[36]);

[30] Diaz, S., Demissew, S., Carabias, J., Joly, C., Lonsdale, M., & Ash, N. (2015). The IPBES conceptual framework connecting nature and people. Curr Opin Environ Sustain 14, 1-16.
[31] Gómez-Baggethun, E., Martín Lopez, B., Barton, D., Braat, L., Saarikoski, H., Kelemen, M., García-Llorente, E., van den Bergh, J., Arias, P., Berry, P., Potschin, L.M., Keene, H., Dunford, R., Schröter-Schlaack, C., Harrison, P. (2014). State-of-the-art report on integrated valuation of ecosystem services. European Commission FP7 FP7 OpenNESS Project Deliverable 4.1., 33p.
[32] Houdet, J., Chikozho, C. (2015). The Valuation of ecosystem services in South African Environmental Impact Assessments. Review of selected mining case studies and implications for policy. The Journal of Corporate Citizenship Issue 60, pp. 58-79.
[33] Ibid 14.
[34] Ibid 13.

[35] Smit, A. (2014). The contextualisation of CSR in sub-Saharan Africa: the territory, the map and the challenges. Discussion paper - UJ Sociology, Anthropology & Development Studies, 14p.
[36] KPMG (2016). KPMG Survey of Corporate Responsibility Reporting 2015. 26p.

- Environmental Management Systems and associated standards (e.g., Kehbila *et al*., 2009[37]; Turner and O'Neill 2007[38]);
- No-net-loss and the Impact Mitigation Hierarchy (e.g., Aiama *et al*., 2015[39]; BBOP 2013[40]);
- Fair and equitable sharing of benefits in accordance with the Convention and the Nagoya Protocol;
- Labelling and certification schemes (e.g., Gulbrandsen 2010[41]; KPMG 2012[42]; UNEP-WCMC 2011[43]);
- Inclusive Green Growth approaches (e.g., AfDB *et al*., 2012[44]; UKAID 2010[45]; UNEP 2010[46],2011[47], 2013[48]);
- Greener public procurement (e.g., Grolleau *et al*., 2004[49]; Lundberg *et al*., 2009[50]);

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[37] Kehbila, A.G., Erten, J., Brent, A.C. (2009). Uptake of voluntary Environmental Management System initiatives by South African automotive industries. Journal of Corporate Citizenship 35, 55-66.
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- Environmental fiscal reform (e.g., Schlegelmilch and Joas, 2015[51]; Slunge and Sterner 2009[52]);
- Greener trade agreements (Arnell 2003[53]; Berger *et al*., 2017[54]; Mao *et al*., 2015[55]; Sheldon 2006[56]).

In addition, to work towards effective biodiversity mainstreaming in manufacturing requires identifying the key gaps in current national biodiversity strategies and action plans and the associated CBD national reporting. This would allow for more effective engagement with the key actors in the manufacturing sector space.

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