



Apple – Sustainability Action Plan

“When you know better, do better”

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Integrative thinking is innovative and,

Diligently reciprocal

“Collaboration is the new competitive edge steering business governance”



Fig. 1: Truths of reconciliation - Angus Reid.

Whereas Business inspired artificial social status renders “social exclusion”, it thus, unjustifiably deprives a person’s proprietary human dignity. But, the most primitive, instinctive emotional expressions and gestures of ‘reciprocity’ enact our fundamental human element of benevolence has audaciously made “profit” a subordinate in accomplishing harmony with nature and perceived happiness. Therefore, business and globalization befit a sustainable world that is inextricably linked to ancestral, authentic means to diminish the catalyst of human-caused climate change. For example: “Indigenous fire stewardship blends intergenerational knowledge, beliefs and values with advanced methods of controlling several aspects of fire. Small, prescribed or cultural fires can recycle nutrients into the soil and support the growth of plant species used for food and medicine. Fire stewardship can also protect communities: fire is commonly applied in the spring and fall to reduce the risk of lightening fires that may harm communities in the summer months”, (Wickham & Trant, et al., 2021). Therein, generations

internalize insights as core values for mutual relationship with communities, nature, and society along with due prosperity and equitable human well being in the present and future.

“Walk lightly in the spring,

Mother earth is pregnant”

Indigenous community proverb

Thereby, rejuvenation of our global culture of humanity and circularity merged with systematized regenerative mechanisms and conservation technology can dispel business tension to provide goods, alleviate social stressors and sustain the “Dignity of Life” for all citizens of the earth. In this era of globalization, ‘Dignity of Life’ is a paradigm pivoted on “Risk based thinking” within Sustainability compliance and leadership. In the wake of Climate change and impact, this defense mechanism demonstrates the intention of purposeful leadership; environmental emergency causing harm to the entire global population and, adaptive strategies that can drive value for the organization in protecting its tangible and intangible business assets for the long term.

Emerging from our preliminary report themed “Adversity is the breeding ground of innovation”, we want to extend, in this report, our examination delving into Sustainability value chain with an ESG focus, upstream and downstream as it pertains to the core of Apple’s business. Also, how it leads to Apple’s impact on Climate change, identifying the boundaries of GHG emissions, its measurement, reporting and verification processes associating relevant stakeholders alongside mitigation, adaptation and transition projects assuring a sustainable and purposeful business.

CLIMATE CHANGE AND RACE TO NET ZERO

Apple's cutting edge Information & Communication Technology (ICT) is researched, designed and developed in U.S. A. These world renowned products are predominantly manufactured in China. The virgin raw material extraction, processing and supply, manufacture of almost 400 types of components, related chemical processes, assembly, packaging supplies and transport has been outsourced to suppliers spanning nearly 40 countries.

The Green House Gas (GHG) Protocol Corporate Accounting and Reporting Standard

The Net zero commitment requires all GHGs to be addressed, not just CO₂. Therefore, *mitigation and reduction targets that address only CO₂ for its supply chain is not addressing the entirety of the problem and can only be considered 'carbon-zero'*, (LRQA, 2021). But, Apple trends with making energy-efficient products with renewable or recycled materials and with renewable energy. Below is the iPhone 11 product declaration short of complete disclosure of all emissions in the LCA plus phone memory capacity variations.

iPhone 11 life cycle carbon emissions – 72 Kg CO₂

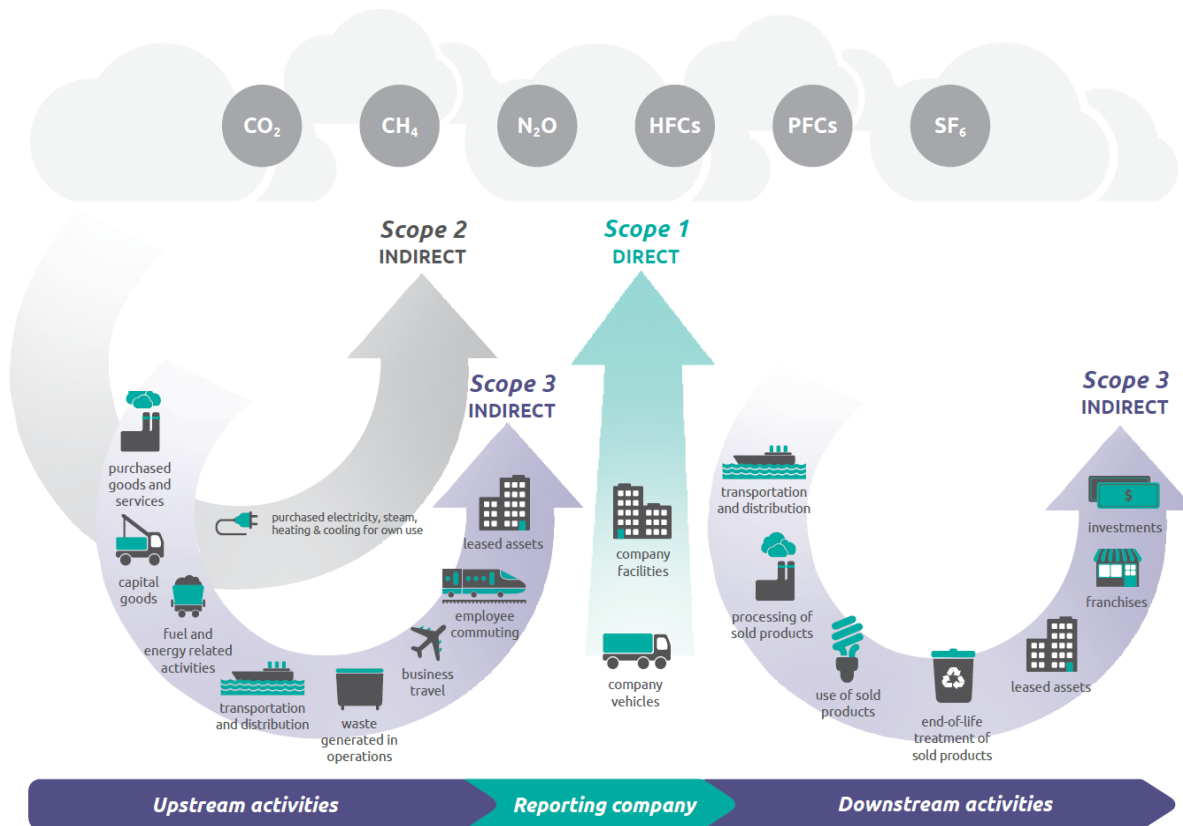
79% Production,

3% Transport,

17% Use ,

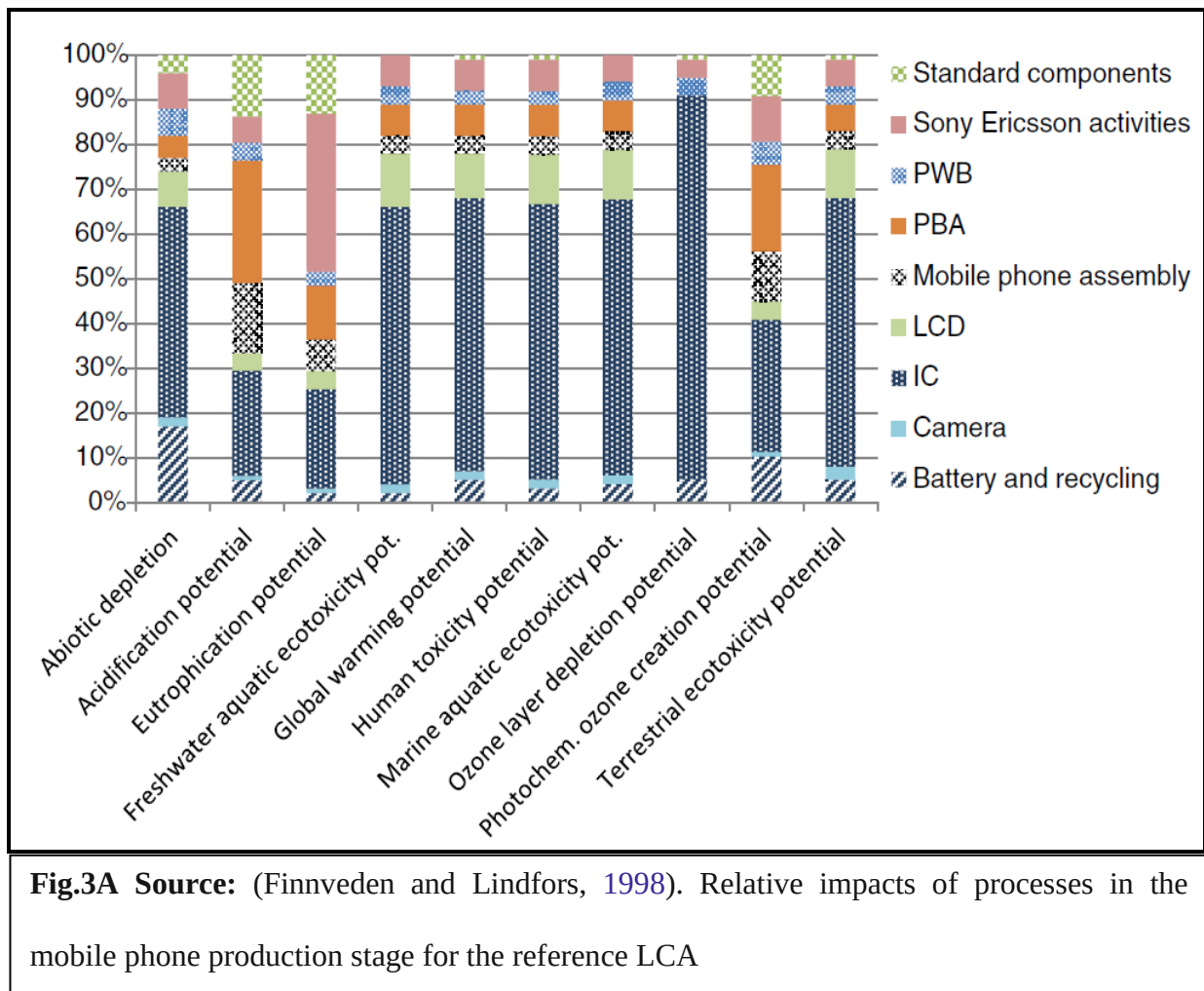
1% End of Life processing.

Fig 2 source: GHG Protocol – The Path to Net Zero – Understanding the fundamentals



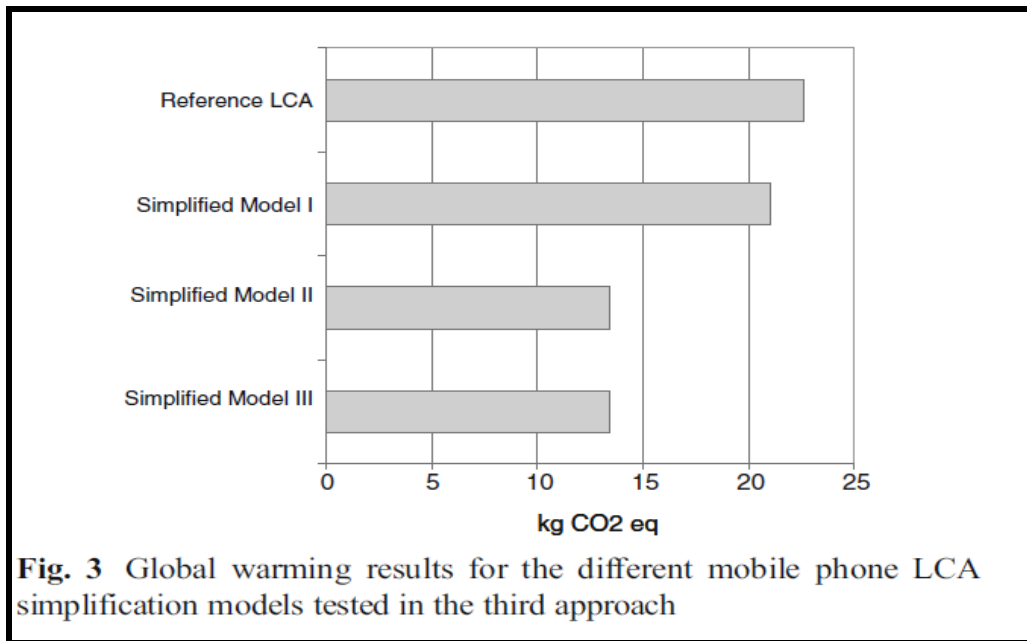
In general, climate change has caused the use of carbon foot printing, assessing only the Global Warming Potential (GWP); (Finnveden and Lindfors, 1998).

Any focus on one particular impact category is known as simplification of LCA by taking advantage of reliable off- the- shelf data on Co2 emission. This means remarkably reducing the need for other emissions data, Sony Ericsson phone in the reference LCA in **Fig. 3A**, (Finnveden and Lindfors, 1998).



“Apple’s LCA can be compared against five approaches to simplify LCA for a mobile phone:

- (1) Excluding environmental impact categories,
- (2) Excluding life cycle stages/processes,
- (3) Using secondary process data from a commercial LCA database,
- (4) Using economic input-output data from national environmental accounts
- (5) Using a linear model. Simplifications relating to end-of-life treatment of the mobile phone not assessed.”



“This study indicates that it is not possible to identify one or a few impact categories which were representative of all others. When some impact categories were excluded, significant information was lost. *The GWP indicator could not be used as an indicator for, e.g. toxicity impact categories, although most processes/activities identified as being of high importance for GWP are also important for toxicity.* This was because the toxicity impacts emerging from raw material extraction affected the toxicity categories more than GWP, although the dominant toxicity impact from fuel incineration co-varied with GWP.”, (Moberg et al., 2014).

Apple is committed to achieving Net Zero by year 2030 and has registered its CDP report for 2021 for GHG except Water and Waste monitored by the Carbon Disclosure Standards Board (formerly, CDP) and received an “A -” rating for GHG emissions. However, it has acknowledged that the current report is not SBTi compliant. This denotes a literal avoidance of the Scope 3 supply chain emissions except the employee and business travel plus electricity from renewable sources at the offices and co-located facilities that do not represent production facilities. Therefore, Apple is required to comply with SBTi in order to be transparent with its

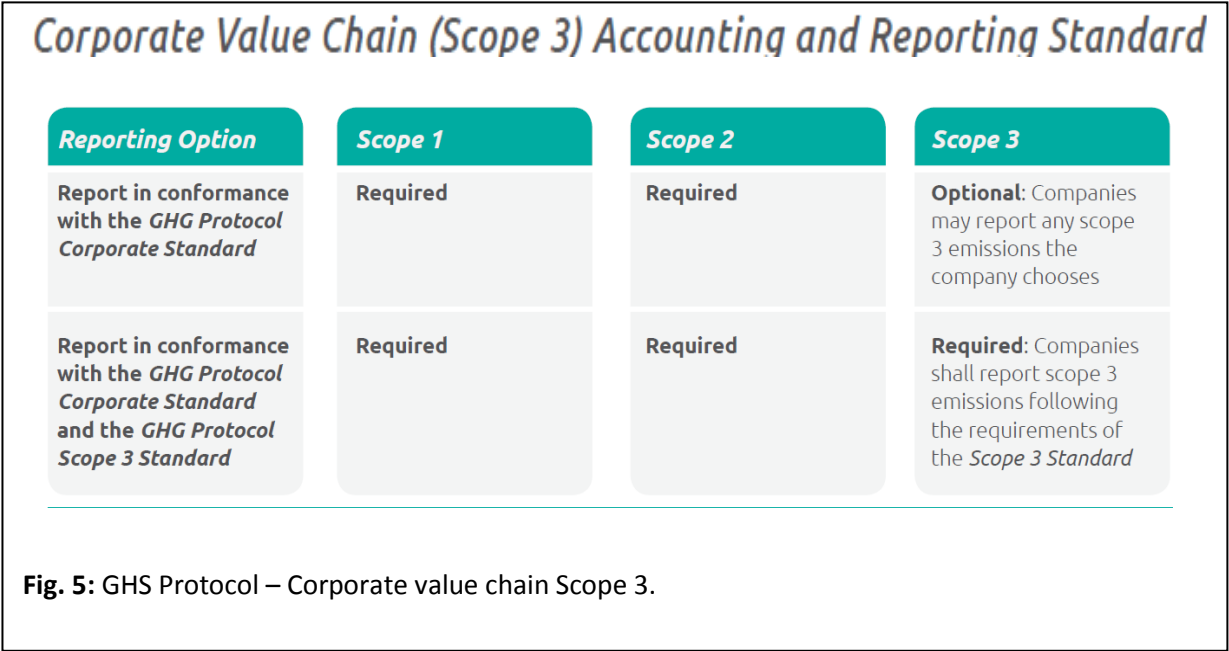
volume and degree of impacts on climate change by redefining its operational boundaries as described in the following study of DHL Nordic Express.

SETTING OPERATIONAL BOUNDARIES

DHL Nordic Express included scope 3 emissions in its inventory of the GHG protocol and promoted GHG reductions throughout the value chain addressing a total of Scope 3 emissions at 327,634 tCO₂ **against** Scope 1 - 7265 tCO₂ and Scope 2 - 052 tCO₂. Hence, DHL Express Nordic increased the relevance of its emissions footprint, expanded opportunities for reducing its impacts and improved its ability to recognize cost saving opportunities. Without scope 3, DHL Express Nordic would have lacked much of the information needed to be able to understand and effectively manage its emissions.

Fig.4 Source: Green House Gas Protocol, Revised edition 2004.

In accordance with GHG Protocol – Corporate Value chain (scope 3) Accounting and Reporting Standard, Apple has complete operational control over its ICT products and services (electronic applications) called “Apps” from the research and design stage to End of life; Cradle - to - grave.



Smart phones are a complex (ICT) solution. Therefore, it is paramount to understand Apple's Chosen reporting boundary for GHG reporting and its existing LCA Goal, Scope, Mining model and Time frame for waste decomposition in order to identify the Life Cycle Inventory (LCI). Additionally, the impact of User profiles that include the Consumer and Mobile data network systems because the Mobile phone concurrently generates new data upon its intended usage in communication and creation of new data, content and information exchange. (Ercan et al.,2016).

Here are five different Full LCA (FLCA) of smart phones examined for comparable LCA providing Product Environmental Footprint (PEF) and Global Warming Potential Indicators (GWPI); (Andrae & Vaija, 2017). This undertaking addresses the volume of *avoided emissions* from recycling, and recovery mechanisms that have influenced the LCA CO₂ calculations provided in Apple's product declarations available to the public for ready comparison; *Facts vs. Fusion*.

Fig.6: Main characteristics of Full Life Cycle Assessment (FLCA) studies and Open Eco Rating LCA (OLCA) Model.				
Feature	FLCA of Phone A [13]	FLCA of Phone B [14]	FLCAs of Phones C-E [15]	OLCA for All Phones
Life Cycle Assessment (LCA) conceptual model	Attributional LCA (ALCA)	ALCA	ALCA	ALCA
Standard followed	ISO 14040 and ISO 14044, ETSI 203 199 [34]	None	ISO 14040 and ISO 14044	None (OLCA itself is however based on FLCAs following ISO 14040 and 14044 standards)

Fig.6. continued.

Note:

1. Open Eco Rating (OER) is a recent rating of sustainability credentials for mobile phones aligned with the ITU Recommendation on eco-rating program for mobile phones.
2. Product environmental impact is one important part of OER and a simplified LCA approach (OLCA) is used for the GWPI and ARDI calculations.

Source: Adapted from Precision of a streamlined Life Cycle Assessment approach used in Eco-Rating of Mobile phones, (Andrae & Vaija, 2017).

Feature	FLCA of Phone A [13]	FLCA of Phone B [14]	FLCAs of Phones C-E [15]	OLCA for All Phones
Number of midpoint indicators included	12 (GWP100, ODP, HumToxCan, HumTox, PM, POCP, AP, EP fresh, EP terr, EcoTox, Water, ADP)	5 (GWP100 ADP elements, ADP fossil, HumTox, EcoTox)	1 (GWP100)	2 (GWP100 and ADP)
Reference for midpoint indicators	International Life Data System 2011 Midpoint + version 1.08 [30]	CML 2001	Intergovernmental Panel on Climate Change (IPCC)	International Life Data System 2011 Midpoint + version 1.08 [30]
Functional unit	"life time usage (3 years) of the smartphone device and its accessories for a representative usage scenario"	"an intensive smartphone use over three years"	"a three-year period for power use by first owners"	"life time usage (2 years) of the smartphone device and its accessories for a representative usage scenario"
Temporal scope	1 to 3 years	3 years	3 years	2 years
Geographical scope, intended market for use	Global	Europe	Global	Global
Life cycle scope	Cradle-to-grave	Cradle-to-grave	Cradle-to-grave	Cradle-to-grave
Metal recycling credited	Yes	Yes	No	No
Secondary data sources	GaBi, ecoinvent	GaBi, ecoinvent	Not transparent	Environmental Impact Made Easy (EIME©) [35]

Double Materiality & Supply Chain Sustainability Risk (SCSR)

“The very purpose of sustainability, ESG, and also materiality is making sure that they take into account *their impact on the ecosystem within which they operate*, and *how that ecosystem impacts them*, only with this long-term view will they succeed—they won’t be short sighted or surprised by impacts that they hadn’t foreseen,”(SASB, 2021). Materiality is more than a technical exercise as it serves business critical insights for strategy and risk management to critical management functions, senior executives and the board for informed decision making and recreating a suitable organizational culture.

The approach taken by stakeholders, i.e.: regulators and investors consider “data-driven materiality”; “it moves the conversation away from opinions about sustainability topics and toward facts and insights”. Data driven materiality augments the monitoring, validation and reporting with consistency, relevance and comparison for decision making on matters of unprecedented non financial issues related to climate crisis and the global and regional industry specific topics and sustainability risks not visible in normalized voluntary materiality assessments. Lost business opportunities are instantly discovered in the Double Materiality assessments, thus facilitating a resilient business strategy for long term success.

Fig. 7. Source: System boundaries for Full LCA (FLCA) and Open Eco Rating LCA (OLCA), (Andrae & Vaija, 2017). *The vulnerability of human capital has been recognized in the UN Sustainable Development Goals.*

Complexity of the manufacturing chain and the short innovation cycles make Data collection difficult and to develop Environmental Product Declaration (EPD).

Main Unit Process	FLCA of Phone A	FLCA of Phone B	FLCAs of Phone C-E	OLCA for All Phones
Gold production	Yes (!)	Yes (!)	Not transparent (N.T.)	Yes (!)
Screen production	/	/	N.T.	/
IC production	/	/	N.T.	/
Flexible Printed Circuit Board (PCB) production	/	/	N.T.	/
Rigid PCB production	/	/	N.T.	/
Production of other electronic parts on the PCB Assemblies (PCBAs)	/	/	N.T.	/
Camera production	/	/	N.T.	/
Plastics production	/	/	N.T.	/
Aluminum production	/	/	/	/
Steel production	/	/	N.T.	/
Battery production	/	/	N.T.	/
Charger production	/	/	N.T.	/
Other Parts production	/	/	N.T.	/
Manual production	/	/	N.T.	/
Packaging production	/	/	N.T.	/
Assembly	/	/	N.T.	/
Distribution	/	/	/	/
Use	/	/	/	/
End-of-life	/	/	/	/
Support activities	/	No	N.T.	No

ORGANIZATIONAL CULTURE

An organizational culture change is imperative especially for Apple is an OEM that has outsourced its complete process from Cradle -to –grave assuming partisan accountability in the net impacts from its product eco-system.

Apple must consider the repercussions (Fig.8) and its product designs, material composition, extended responsibility, liability and compliance to evolving regulations aligned with TCFD and the Double materiality imperative. Therefore, Apple must assess, document, coordinate and manage Scope 3 alignment and compliance with the Ten Principles of UN Global Compact through their products entire lifecycle and enforcing it throughout the supply chain.

Despite the annual audits, deemed inadequate, and compliance reports published on the website and the implementation of a Supplier Code of Conduct, NGO's like Amnesty International have published human rights allegations at Apple's largest manufacturing facilities in China, (China Labour Watch, 2021). It is without any doubt, Apple requires extended visibility beyond its Tier 1 suppliers and the necessary human and financial resources allocated into its sustainability chain monitoring and compliance with data integration, especially in China, (Datamaran, 2021)

Fig. 8. Source: MIT Sloan Management Review,2021.

Elements of Adaptive culture assessment

CUSTOMER CENTRICITY												
More product-centric	-5	-4	-3	-2	-1	0	1	2	3	4	5	More customer-centric
ECOSYSTEM FOCUS												
More company-focused	-5	-4	-3	-2	-1	0	1	2	3	4	5	More ecosystem-focused
ANALYTICAL ORIENTATION												
More decision-making informed by judgment	-5	-4	-3	-2	-1	0	1	2	3	4	5	More decision-making informed by analytics
COLLABORATIVE REFLEX												
More hierarchical control and coordination within silos	-5	-4	-3	-2	-1	0	1	2	3	4	5	More lateral collaboration and teamwork
BIAS TO ACTION												
More risk minimization	-5	-4	-3	-2	-1	0	1	2	3	4	5	More speed maximization
LEARNING MINDSET												
More planning and execution	-5	-4	-3	-2	-1	0	1	2	3	4	5	More experimentation and learning
LEADERSHIP VALUE CREATION												
More focus on direction and oversight	-5	-4	-3	-2	-1	0	1	2	3	4	5	More focus on coaching and empowerment

Culture Readiness Score

If your organization's score totals 20 or less, or if it's on the negative side on any of the dimensions, you likely have work to do on your culture, especially if you hope to successfully engage in transformation.

CHANGING TO A CIRCULAR MODEL OF CORPORATE GROWTH

Apple reported One billion iPhones in use. Data shows that unit sales have been declining since 2015. Americas are Apple's largest regional market, bringing in net sales of 36.82 billion U.S. dollars in the fourth quarter of the company's 2021 fiscal year. Europe and Greater China are two other major markets. Yet, Apple's product eco system is presented with a new business opportunity to "Expand the Pie", (Harvard PON, 2021) by envisioning a Cradle –to- Cradle LCA, taking advantage of the reuse, reduce, recycle and recovery potential of the raw materials embedded in iPhones, computers etc.

Fig.9, Source: Knoema.com - Apple iPhone Sales Worldwide

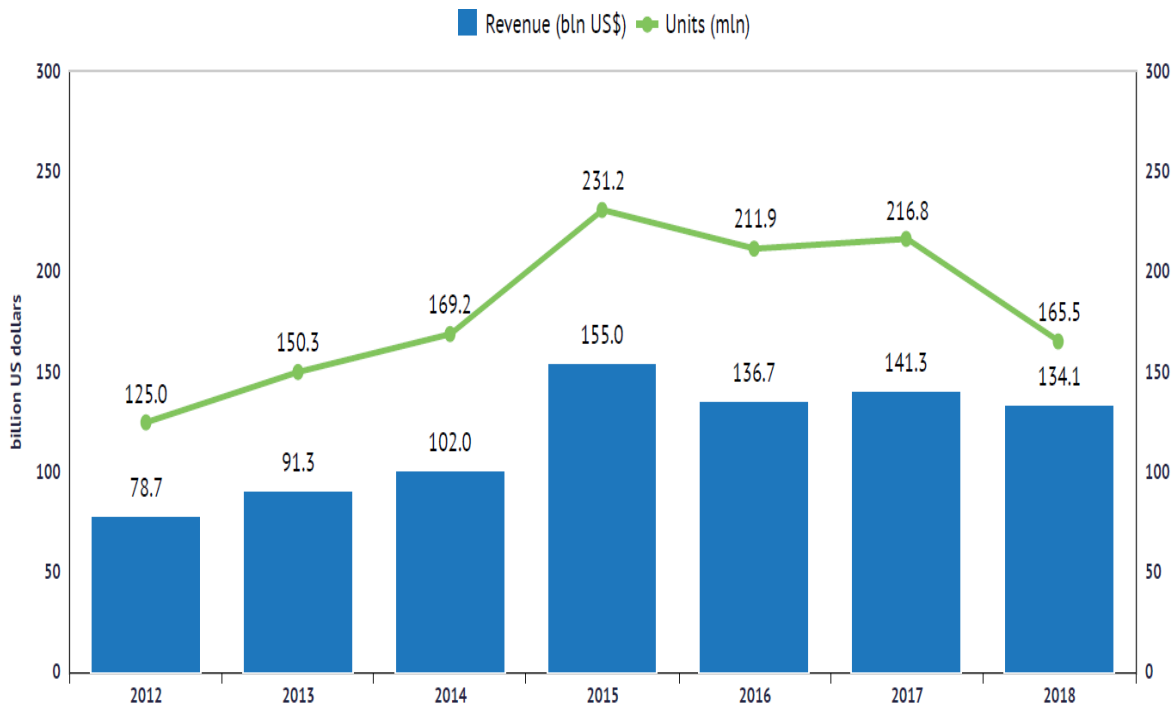


Fig. 10. Source: Knoema . Com - Apple Revenue by product, % of total revenue 2015 Q1 – 2019 Q4

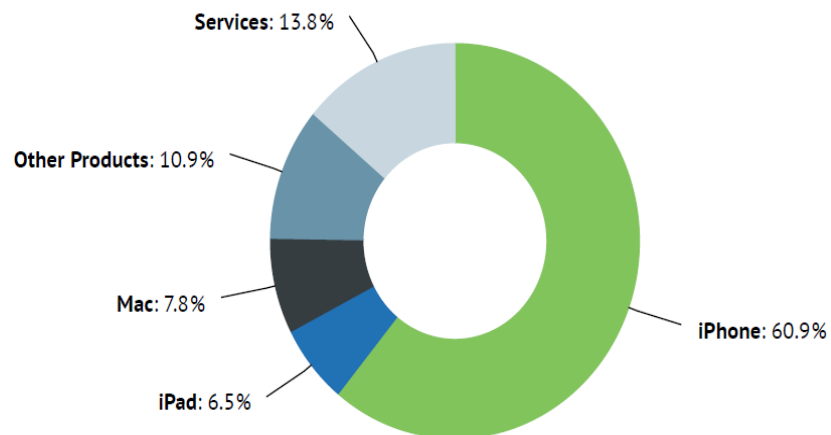


Fig 11. Author: (Neranjana, T., 2022) – Analysis of GHG/Kg CO₂e vs. Internal memory capacity used for an Open LCA, Virgin material substitution and declaration for ECO Rating. **Data source:** Adapted from Apple Product Declaration and iPhone sales data USA 2014-2021 Q1, (Statista research, 2021).

Apple iPhone sales in USA - 2014 to 2021 Q1 - Source: Adapted from Market research sales data of Statista and Apple Product declaration (P.D.)																
Phone Model	Internal Memory GB	Apple P.D: GHG/ KgCO ₂ e	Sep. 2014	Sep. 2015	Sep. 2016	Dec. 2016	Sep. 2017	Dec. 2017	Jun. 2018	Sep. 2018	Dec. 2018	Jun. 2019	Sep. 2019	Mar. 2020	Dec. 2020	Mar. 2021
iPhone (2007)	16		N/A													
iPhone 3G (2008)	16	33	N/A													
iPhone 3GS (2009)	32	33	N/A													
iPhone 4 (2010)	32	43	N/A													
iPhone 4S (2011)	64	33	9%													
iPhone 5C	32	30	13.30%	3%												
iPhone 5S	64	73	30%	19%												
iPhone 6	128	93	33%	33%	3%											
iPhone 6 Plus	128/ (32 GB)	63	12.30%	19%	7%											
iPhone 6S	128/ (32 GB)	61/ 34	16%	19%	11%	10%	6%	8%	7.50%							
iPhone 6S Plus	128/ (32GB)	70/63	8%	12.30%	10%	4.30%	2%	3%	3%							
Gen 2016	128/ (32GB)	33/ 43		9.30%	6%	11%	7%	8%	3.30%							
iPhone 7	128/ (32GB)	63/ 67		31%	40%	28.30%	13%	16%	10.30%	7%	8.00%					
iPhone 7 Plus	128/ (32)	74/ 67		16%	32.10%	29.30%	11%	11%	9%	4%	4.00%					
iPhone 8	256 / (64GB)	71/ 57				6%	24%	13%	16%	12%	11.30%					
iPhone 8 Plus	256/ (64GB)	82/63				10.30%	17%	24%	16.30%	13%	10.00%	13.40%	14%			
iPhone X	256 (64GB)	93/79					20.10%	17%	14.30%	0%	0.00%	0.00%	0.00%			
iPhone XS	(64GB) /256/312	70/85/99							7.30%	9%	10.00%	0	21%			
iPhone XS Max	(64GB) /256/312	77/91/106							18.30%	17%	9.00%	17.3	6.0%	9%		
iPhone XR	(64GB) /128/256	62/67/76								40%	48.00%	39.2	37%	17.0%	25%	
iPhone 11	(64GB) /128/256	72/77/39										14.3	13%	7.3%		
iPhone 11 Pro	(64GB) /256/312	80/96/110										13.4	14%	4.0%		
iPhone 11 Pro Max	(64GB) /256/312	86/102/117														16%
iPhone SE (2nd Gen 2020)	(64) /128/256	37/62/73												9.3%	6%	
iPhone 12	(64) /128/256	71/75/83													17.0%	22%
iPhone 12 Pro	(128) /256/312	82/93/107													32.0%	20%
iPhone 12 Mini	(64) /128/256	64/69/80													6.3%	0%

Analysis of the iPhone global sales, the individual models and their GWP / KgCO₂ has presented (Fig.9, 10, 11) with promising business expansion opportunities. First, USA is the dominant market for iPhones with 50% of its unit sales plus additional “App” services that have been increasing with additional revenue, (Statista, 2021). Based on data, Apple has the potential to add

additional sales revenue by creating new market segments, product and services to acquiring a larger market share within USA in a very short period of 3-5 years as proposed here.

1. Embracing a purposeful “Open LCA” would lead to identifying the LCI necessary to validating the environmental, social and economic impacts of the product eco system. Thus, prioritize its product design, retirement and expansion objectives affecting climate change and the Net positive impact.
2. Use the Apple retail stores to provide repair services or exchange of the iPhones introducing “Free upgrades to a higher or a newer model, Equal payment Instalments deducted from the bill with Apple Co-Pay or totally Lease the phones on 2 or 3 year terms. This initiative has the prospect of developing a Circular economy, Human development and Capacity building novel to the Apple eco-system and the industry.
3. Establish a separate segment for Pre-owned / Refurbished iPhones available at every Apple store as this would reckon and recognize the prospective customers; who were marginally lacking the economic affordability, would also enjoy the pride and social status attached and access to Apple products.
4. Expanding the market size, prospect of 500 million refurbished units, subject to further analysis by the Marketing division, would bring Apple a Spin-off revenue from “App” services used by New users of Refurbished products.
5. Introduce a (PSS) Product Service System, taking advantage of the innovative technologies in material recovery for reuse in its repair services, refurbishment and new product development; particularly sharing capacity partnered with Mobile networks and cloud computing to “minimize the Built -in phone memory size to a standard 64 GB” aimed at reduced virgin material use (512GB to 64/256GB) disrupting the impact on climate change and on ESG.

6. Penetrate the lucrative Online Video gaming industry by leveraging the PSS capacity.

HUMANIZING THE PURPOSE & CORPORATE STRATEGY

“EXPAND THE PIE” – from Resources to Product Eco-system

The Chief Sustainability Officer and, her Team, operate as “Mediators”, facilitating the reorientation toward corporate strategy and initiating the creation and convergence on a new corporate value statement. This process of engagement with a new “backbone” team representing all departments and levels of employees: comprising the global, internal and external stakeholders create and commit their action oriented contribution. The scope is not a “Buy in” exercise, rather a “Breathe in” exercise born of own inspiration of the representatives, (Inam, H., 2021). The exercise must include active interaction of ideas and brainstorming, because Questionnaires and surveys as in the past do limit the purpose and the prospect of a broader outlook.

The new organizational culture must be compatible with Sustainability management steering a renegotiation of the Social license to operate business, thus resolution of man –made conflicts beginning with environmental depletion and the pervasive linear economic growth and its impact on the society, economy, bio-diversity and the human well being. Hence, a fundamental need to close the gap in corporate strategy solving the climate crisis and adopt the evolving standards and regulations for ESG reporting. These circumstances reveal that Apple is poised to succeed with collaborative initiatives exclusively aimed at simultaneously “Creating Value and Claiming Value”, (Burgess, H. & Burgess, G.M., 2003),

This emphasizes the dynamic role of an Integrative Dispute resolution mechanism; “Expanding the Pie” than a Distributive approach to “Divide the pie”, being inconsiderate and claiming the biggest share of resources and benefits in an unequal outcome, (Harvard PON, 2021). Accordingly, ESG seeks first to reconcile the power imbalance between the Environment, Society, Economy and inclusive Governance followed by long term gainful business benefits such as Market leadership, Brand reputation, Trust and financial returns.

APPENDIX: 1

Apple’s current value chain

The “Protectionist Value chain” of Apple, especially for iPhones, demonstrated undue conflicts of interest with its customers even though the products were regarded as a Status symbol of all smart phones. Contract terms and conditions prohibited any customer initiated private repair of defective phones and thus resemble a “non –compete agreement’ imposed on its customers.

Repair Manuals were not published by Apple that prevented any repair venture by third parties. This prompted the rivalry by enthusiast iPhone owners and users. Hence, the birth of a much celebrated entity “iFixit” and their “*annual iPhone tear down*” ritual just minutes after each iPhone model was launched in Sydney, Australia.

In fact, iFixit is the first entity to write and publish Repair manuals for iPhones and Apple computers. Consequently, Apple earned the ire of U.S. President Joe Biden in July 2021 for its negative business attitude and indifference to the simmering conflict with customers’ Right to repair: *Joe Biden Wants You to Be Able to Fix Your Own Damn iPhones*. A sweeping new presidential directive includes, among other things, an initiative to secure consumers’ right to repair their own devices, (Goode, L., 2021).

Therefore, under growing pressure from consumers and regulators around the world, Apple has notified in November 2021 of launching a repair program, initially be available only for iPhone 12 and iPhone 13 users, but will later expand to Mac computers that use Apple's new in-house M1 chip.

The company will only reveal the prices of its spare parts when the program formally launches next year, but Apple said it will charge individual users the same prices it currently charges independent repair providers (Iyengar, R., 2021).

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