Greening the Economy Through Life Cycle Thinking

Ten Years of the UNEP/SETAC Life Cycle Initiative
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- Bernard Mazijn (Ghent University, Belgium)
- Pere Fullana i Palmer (UNESCO Chair in Life Cycle and Climate Change, Escola Superior de Comerç International, Barcelona, Spain)

Project Management Office Chairs (former International Life Cycle Board Co-Chairs)
- Guido Sonnemann (Bordeaux University, France) - Phase 3 Project Management Office Co-Chair
- Jim Fava (PE INTERNATIONAL and Five Winds Strategic Consulting, USA) - Phase 2 Coordinating Committee Chair and Phase 3 Project Management Office Co-Chair

Work Areas Chairs (listed alphabetically)
- Allan Astrup Jensen (Nordic Institute of Product Sustainability, Environmental Chemistry and Toxicology, Denmark) - Chair of the Work Area on LCM for Business and Industry
- Andreas Ciroth (GreenDeltaTC, Germany), and Till Bachmann (EIFER, Germany) - Co-Chairs of the Work Area on Life Cycle Methodologies and Data
- Hongtao Wang (Sichuan University, China) - Chair of the Work Area on Capability Development
- Jim Fava (PE INTERNATIONAL and Five Winds Strategic Consulting, USA) - Chair, and Amy Costello (Armstrong World Industries, USA) - Co-Chair of the Work Area on LCA for Consumption Clusters
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Evolution can be described as a serendipitous coming together of enabling circumstances, conditions and opportunities leading to significant transformation. This publication, *Greening the Economy Through Life Cycle Thinking*, marks 10 years of work by the UNEP/SETAC Life Cycle Initiative. It provides a glimpse into the current practice of life cycle approaches, combined with a retrospective of the related activities of the Initiative that have pushed the agenda forward. It also clearly shows the evolution that has taken place in life cycle assessment.

The development of life cycle thinking parallels the evolution of broader trends within the environmental movement. During the 1980s, efforts were primarily focused on the production side via end-of-pipe technology fixes to reduce pollution at the source. In the '90s, it was becoming clear that the Earth's capacity to absorb the growing amounts of pollution to land, water and air was being overwhelmed. This gave rise to cleaner production (more output with less pollution), resource efficiency (more output with less raw materials), and the ISO 14001 standard of environmental management (continuous environmental improvement of production). Over this period, life cycle impact assessment gained a foothold, first in the area of energy due to the energy crisis, and then broadened to raw material inputs as well as waste outputs. These developments allowed life cycle approaches such as environment-based supply chain management, and material recovery/recycling programmes to take root.

As the new millennium neared, research showed that the resources required to meet the increasing needs (and wants) of the growing global population would overtake the capacity of what the Earth could provide. It became clear that a broader approach addressing the consumption side of the economy was needed, and cleaner production and sustainable consumption have since been regarded as ‘two sides of the same coin’. The same broadened approach was transposed into new and extended life cycle tools and approaches addressing consumption, such as third-party ecolabel certifications, detailed environmental declarations, and products sold in concentrated form. Life cycle management was initiated as a strategy for enterprises to operationalize life cycle thinking and apply its related tools in a methodical way, based on a principle of continual improvement.

More recently, concerns about the health implications of everyday products have led consumers to demand more information about the ingredients and substances being used, and has encouraged the linking of risk assessment and related tools with life cycle assessment. A focus on the conditions of workers, particularly in the electronics and clothing supply chains, has introduced a social assessment component, which together with life cycle costing and life cycle impact assessment, enables a triple bottom line approach that considers environmental, social and economic aspects in product impact assessment.

And, finally, one must consider the concurrent advances in information technology that now enable us to keep track of, manipulate, and analyze staggering amounts of life cycle data in order to model the potential future consequences of our current production and consumption decisions, and then communicate the results in easily understandable terms to a global audience.

So where has this evolution led us? Life cycle approaches and tools now cover the entire product value chain, considering impacts from raw materials extraction to human health. Products’ assessments can be undertaken using a triple bottom line sustainability approach. Consumers can comfortably access this information online or in stores, and select products that are better and safer for their families, the environment, and the workers along the supply chain. The pieces are in place for the transition to a green economy within the context of sustainable development and poverty eradication, and they are based on life cycle thinking, approaches and tools.

Of course, evolution is an on-going process. The evolution of life cycle approaches and tools will continue beyond Rio+20 through the support and activities of the UNEP/SETAC Life Cycle Initiative and its growing network of stakeholders and practitioners. We invite you to join us, and be a part of the evolution in the years to come.

Mr. Achim Steiner
UN Under-Secretary General
UNEP Executive Director
SETAC FOREWORD

The UNEP SETAC Life Cycle initiative, now ten years underway and still gaining strength and impact, has become a very important foundation for SETAC’s international engagement. The significance and importance of life cycle assessment, management, and thinking in general is becoming more clearly understood in business management circles as well as a broader, interdisciplinary, even trans-disciplinary context for bringing the best environment thinking and tools together with the real economy.

As you read on, you will see the modest start that prepared the ground for the Initiative, and the valuable work done during the years preceding the establishing of the Initiative in 2002. We are now in the year of Rio + 20 and the need to “green” the economy is an accepted goal by political and economic leaders around the world. At the same time, the conceptual framework for life cycle assessment and thinking has broadened, and needed work is ongoing to capture the human and social dimensions as well. The work undertaken during the ten years of the Initiative has contributed to the development of key methodologies and tools.

These successful efforts under the Initiative have also led us together to take on the perhaps daunting task of “mainstreaming” this knowledge and approach to business and environmental management to make it a common approach at all levels of the economy and among broad population and consumer groups. This “Phase 3” is currently in preparation as we celebrate our successful ten years working together with UNEP and our broad circle of LCA and LCM practitioners, and we believe that such a strong and well-conceived foundation will lead to still further success following the Rio + 20 discussions this year. The Initiative’s extensive networks are an excellent point of departure, and the lessons and knowledge demonstrated in this publication will serve as the initial guidebook.

We join UNEP and our friends and collaborators in the LCA and LCM communities in pride of the Initiative’s accomplishments over the past decade. We also join them in welcoming the future challenges in bringing economy and environment concerns together as we work to achieve a more sustainable post-modern and post-industrial world.

Mr. Michael C. Mozur
Society of Environmental Toxicology and Chemistry (SETAC)
Global Executive Director
EXECUTIVE SUMMARY

Since the first Rio Summit on Sustainable Development in 1992, progress has been made to address, and in some cases, reduce the burden that the global economy puts on the environment. In other cases we still face challenges that, without rapid action, could lead humanity down a path of unknown consequences for preserving fragile ecosystems, wildlife populations, and human livelihoods. It is in this context that policy makers and business leaders gather again in Rio de Janeiro, twenty years later, to take stock of the state of the environment and of progress toward bringing prosperity to the world's poorest people.

The root of the problem, as it was 20 years ago, are the prevailing unsustainable patterns of consumption and production. Feeding, clothing, sheltering, and providing the other wants and needs of the global population exceeds the Earth's available resources and carrying capacity. Finding appropriate solutions risks to be more complicated this time around with the looming specter of climate change, increasing water scarcity and the expanding consumption power of the growing global middle-class.

Tweaking and fine-tuning protection of the environment with laws and regulations has followed a 'dart-board' approach, and has led to improvements. But the challenges we face are overwhelming these partial solutions – it is now clear that the foundation upon which the current global economic system is based is no longer viable. Thus, one of the main themes at this Rio Summit focuses on the need for a rapid transition to a global green economy, and much discussion will be directed toward how this transition can be supported and stimulated.

Over the past two decades, life cycle thinking has provided a conceptual basis for moving the agenda forward. Life cycle approaches and tools have been developed and refined, are now more commonplace in the private and public sector, and are already stimulating and supporting the transition to a green economy. Changes are already taking place and have created a ripple-effect along entire supply chains, going beyond individual companies, crossing diverse industry sectors, and touching both developed and developing countries.

Life cycle thinking represents a holistic approach, examining the impacts of a product from its humble beginnings as raw materials, through production, use, and final disposal – from cradle to grave. Life cycle management provides a methodology for putting life cycle thinking into action towards continuous improvement. Life cycle tools measure, monitor, and communicate products' impacts, both social and environmental, and reveal the impacts on human health, allowing the worst and the best performing products to be more easily identified. A life cycle approach puts the relevant information into people's hands where and when they need it so that they can make good decisions – to protect the environment, improve the lives of the people who produce the goods, and safeguard the health of the people who use them.

The shift to life cycle thinking with an integration of life cycle approaches is simultaneously taking place in numerous sectors and on different levels. Many private and public sector organizations – multinationals, SMEs, cities, regional governments, among others – have already committed to improving their social and environmental performance by adopting life cycle approaches. Many individuals are using life cycle information available in stores and on the Internet to make purchase decisions. Gone are the days of consumers walking into a store and buying a product based on price alone. In the current era where information is paramount, those not providing the information that their stakeholders, customers, and consumers are demanding will be left behind, as dinosaurs on the way to extinction.

The UNEP/SETAC Life Cycle Initiative has been active over the past decade to help bring the life cycle approach and the related tools to maturity. It has been at the center of efforts to generate life cycle tools that have the potential to provide a full triple bottom line breakdown of a product's impacts. It has helped to bring together the required human resources for developing and using the tools that exist via the international network of life cycle practitioners, which continues to expand. In the coming years, the Life Cycle Initiative will continue to work towards mainstreaming life cycle approaches and tools in support of the transition to a green economy within the context of sustainable development and poverty eradication.
SOMMAIRE EXÉCUTIF


L’émergence des nouvelles régies et de lois visant la protection de l’environnement ont conduit à des améliorations. Cependant, les défis auxquels nous sommes confrontés sont énormes et les solutions sont partielles - il est maintenant clair que le fondement sur lequel le système économique mondial actuel est basé n’est plus viable. Ainsi, l’un des thèmes principaux lors de ce sommet de Rio met l’accent sur la nécessité d’une transition rapide vers une économie verte mondiale. Dans ce sens, un nombre important de discussions seront dirigées sur la façon dont cette transition pourrait être soutenue et stimulée.

Au cours des deux dernières décennies, la pensée du cycle de vie a fourni une base conceptuelle pour faire avancer l’agenda. Des approches et des outils sur le cycle de vie ont été développés, affinés et sont maintenant connus du secteur public et privé, de ceux qui stimulent et soutiennent la transition vers une économie verte. Des changements sont déjà en cours et ont un impact significatif sur les chaînes d’approvisionnement. Ils vont au-delà des entreprises individuelles et traversent plusieurs secteurs industriels dans des pays développés et en développement.

La pensée du cycle de vie est une approche holistique qui prend en compte les impacts d’un produit depuis l’extraction des matières premières, en passant par l’usinage, l’utilisation jusqu’à l’élimination définitive du produit - du berceau au tombeau. La gestion du cycle de vie inclut une méthodologie pour mettre en place la pensée du cycle de vie des produits et les mener vers une amélioration continue. Les outils de gestion du cycle de vie ont été conçus pour mesurer, contrôler et communiquer l’impact des produits, à la fois sociaux et environnementaux. Ceux-ci prennent également en compte les impacts sur la santé humaine, en permettant d’identifier les produits les plus et moins performants.

Les approches en termes de cycle de vie permettent de fournir la bonne information à la bonne personne et au bon moment afin qu’elle puisse prendre la bonne décision – qui soit orientée vers la protection de l’environnement, l’amélioration de la qualité de vie et de protection de la santé des personnes impliquées dans la production et consommation des biens.

Le passage à la pensée en termes de cycle de vie avec une intégration des approches du cycle de vie se déroule dans de nombreux secteurs et à différents niveaux, simultanément. De nombreuses organisations dans le secteur privé et public - multinationales, PME, villes, gouvernements régionaux, entre autres - se sont déjà engagés à améliorer leur performance sociale et environnementale en adoptant des approches axées sur le cycle de vie. De nombreux consommateurs utilisent également l’information disponible sur le cycle de vie des produits dans les magasins et sur Internet au moment des décisions d’achat. Ces décisions ne sont plus uniquement basées sur les prix des produits. Au jour d’aujourd’hui, l’information est primordiale et ceux qui ne la fournissent pas à leurs parties prenantes, clients et consommateurs, qui deviennent de plus en plus exigeants, seront condamnés à disparaître tels des dinosaures en voie d’extinction.

L’Initiative de l’UNEP/SETAC pour le Cycle de Vie agit depuis dix ans pour l’amélioration de l’approche du cycle de vie et ses outils. Le développement des outils ayant le potentiel de fournir une complète évaluation « triple bottom line » a toujours été au coeur des efforts de l’Initiative. Pour cela, elle a réuni les ressources humaines nécessaires au développement et à l’utilisation de ces outils à travers la création d’un réseau international de praticiens du cycle de vie qui ne cesse de se développer. Dans les années à venir, l’Initiative pour le Cycle de Vie continuera son travail afin de promouvoir des approches et des outils du cycle de vie qui contribuent à la transition vers une économie verte.
RESUMEN EJECUTIVO

D esde la primera Cumbre de Río sobre el Desarrollo Sostenible en 1992, se han realizado progresos para manejar, y en algunos casos reducir, la carga que le economía global ejerce sobre el ambiente. En otros casos todavía enfrentamos desafíos que, sin una rápida acción, pueden conducir a la humanidad hacia una vía de consecuencias desconocidas sobre la preservación de ecosistemas frágiles, poblaciones de vida salvaje, y el sustento humano. En este contexto los responsables políticos y los líderes de las empresas se reúnen nuevamente en Río de Janeiro, veinte años después, para hacer un balance del estado del ambiente y de los progresos realizados en la tarea de dar prosperidad a la gente más pobre del mundo.

La raíz del problema, al igual que hace 20 años, es el comportamiento no sustentable de producción y consumo. Alimentar, abrigar, proveer cobijo, y otras necesidades y deseos de la población global excede los recursos disponibles y la capacidad de carga del planeta. Encontrar las soluciones apropiadas es quizás más complicado ahora que en el pasado, con el espectro amenazante del cambio climático, el aumento de la escasez de agua y la capacidad de expandir el consumo de la creciente clase media global.

El ajuste y sintonía de la protección del ambiente mediante las leyes y regulaciones ha seguido un enfoque de “tiro al blanco”, y ha conducido a mejoramientos. Pero los desafíos que enfrentamos son abrumadores para estas soluciones parciales: ahora resulta claro que las fundaciones sobre las que se sostiene el sistema económico actual no son viables. Por este motivo, uno de los temas principales de esta Cumbre de Río se focaliza en la necesidad de una transición rápida hacia una economía global verde, y una profusa discusión se focalizará en cómo se puede apoyar y estimular esta transición.

En las dos últimas décadas, el pensamiento de ciclo de vida ha proporcionado una base conceptual para llevar adelante este propósito. Se han desarrollado y refinado enfoques y herramientas de ciclo de vida, que son actualmente comunes en el sector público y privado, y ya están promoviendo y apoyando la transición hacia una economía verde. Los cambios están ocurriendo, y han creado un efecto dominó a lo largo de cadenas de suministro completas, traspasando las fronteras de las empresas individuales, atravesando diversos sectores de la industria, y alcanzando tanto a países desarrollados como en desarrollo.

El pensamiento de ciclo de vida presenta una visión holística, examinado los impactos de un producto desde sus comienzos como materias primas, a través de la producción, uso y disposición final, es decir, de la cuna hasta la tumba. La gestión del ciclo de vida proporciona una metodología para hacer operativo el pensamiento de ciclo de vida hacia la mejora continua. Las herramientas de ciclo de vida miden, monitorean y comunican los impactos de los productos, tanto sociales como ambientales, y revelan su efecto sobre la salud humana, permitiendo la fácil identificación de los mejores y peores productos, desde el punto de vista de su desempeño ambiental. Un enfoque de ciclo de vida pone en manos de la gente la información relevante, en el sitio y en el momento en que la necesiten, para tomar decisiones adecuadas, para proteger el medio ambiente, mejorar las vidas de las personas que producen los bienes, y salvaguardar la salud de las personas que los utilizan.

El cambio hacia el pensamiento del ciclo de vida con integración de enfoques de ciclo de vida se está llevando a cabo en varios sectores y en diferentes niveles simultáneamente. Numerosas organizaciones del sector público y privado, empresas multinacionales, PYMES, ciudades, gobiernos regionales, entre otros - ya se han comprometido a mejorar su desempeño social y ambiental mediante la adopción de enfoques de ciclo de vida. Cada vez más personas están utilizando la información del ciclo de vida disponible en las tiendas y en Internet para decidir sus compras, quedando atrás aquellos días en que los consumidores compraban un producto considerando solamente el precio. En esta era en que la comunicación es de suma importancia, aquellos que no proporcionen la información exigida por los grupos de interés, clientes y consumidores quedarán atrás, como los dinosaurios en su camino hacia la extinción.

Durante la última década, la Iniciativa de Ciclo de Vida (PNUMA / SETAC) ha contribuido a que el enfoque de ciclo de vida y las herramientas relacionadas alcancen la madurez. Se ha situado en el centro de los esfuerzos orientados a generar herramientas de ciclo de vida que tengan el potencial de proporcionar los impactos de un producto desglosados entre los tres pilares de la sustentabilidad. Ha colaborado para reunir los recursos humanos necesarios para desarrollar y utilizar las herramientas que existen, a través de una creciente red internacional de profesionales dedicados al ciclo de vida. En los próximos años, la Iniciativa de Ciclo de Vida seguirá trabajando para la integración de los enfoques y herramientas de ciclo de vida para apoyar la transición hacia una economía verde.
自从1992年首届世界可持续发展大会在里约热内卢召开以来，对于全球经济发展所造成环境影响的探讨取得了一定的进展，甚至在某些方面已经开始减少这些负面影响。但在很多其它方面，我们仍面临着挑战。如果不采取迅速的行动，可能会对脆弱的生态环境、野生生物种群以及人类生存环境造成难以预知的后果。在此背景下，政策制订者和商业界的领袖们二十年后再一次聚会里约热内卢，评估全球环境以及世界贫困人口的发展现状。

正如20年前一样，我们面临的资源环境问题源自普遍存在的不可持续的消费与生产模式。人类衣食住行和其他需求已经超出了地球可以提供的资源和环境承载力。逐步逼近的气候变化、水资源短缺以及全球中产阶级增长带来的消费膨胀，使得适用的解决方案变得日益复杂，而且找到这些方案的机会充满风险。

尽管对环境保护法律法规的调整和优化已经取得了一些改进，但是全球经济系统的基础显然已不复可行，我们所面临的挑战如此巨大，已非局部性的方案可以解决。因此，本次里约大会的主题之一就是全球绿色经济的快速转变，并且许多的讨论聚焦于如何激发现有生产方式的转变。

在过去的二十年里，生命周期思想为推动绿色经济提供了概念性的基础，生命周期方法与工具不断被开发并得到锤炼，已经在私营和公共部门得到普遍的应用，不断激发并支持着向绿色经济的转变。在生命周期思想推动下，改变已经发生，而且单个的公司，在整个供应链上引发连锁反应，跨越不同的行业部门，影响遍及发达国家和发展中国家。

生命周期思想意味着全面评价产品的环境影响——从最初的资源开采开始，经过生产、使用到最终废弃，包含着产品从摇篮到坟墓的整个过程。生命周期管理引导着将生命周期思想付诸行动并带来持续的改进。各种生命周期工具可以衡量、监测、披露产品的环境、健康和社会影响，便于我们辨识最差和最好的产品。无论何时何地当人们需要时，生命周期方法将相关信息带给人们，使得他们可以做出好的决定，从而保护环境、保护产品生产者和消费者的生活与健康。

许多的行业和部门，正在不同层次上应用生命周期思想和生命周期方法。很多私营组织和公共部门，例如跨国公司、中小企业、城市、地方政府，已经致力于通过采用生命周期方法提高他们的社会和环境表现。许多消费者正在使用从商店和网络上得到的生命周期信息做出采购的选择。消费者走进商店，只通过价格决定是否购买产品的日子已经过去了。在这个信息化的时代，那些拒绝提供向其利益相关方、客户和消费者提供产品环境信息的企业，将会被抛弃，就像走向灭绝的恐龙。

UNEP/SETAC生命周期倡议在过去的十年里一直积极地行动，帮助生命周期方法和相关的工具走向成熟，在生命周期工具的发展中发挥着核心作用，为“triple bottom line”原则在产品上的全面落实提供了支持。在生命周期倡议的组织下，生命周期方法实践者的网络不断扩展，壮大和整合了全球所需的人力资源。在接下来的几年里，生命周期倡议还会持续地推动生命周期方法和工具成为社会的主流，支持向绿色经济的转变。
إلى أصحاب الشأن من الزبائن و المستهلكين، كما كان حال الديناصورات في طريقهم إلى الانقراض.

منذ العقد المنصرم، نشطت مبادرة UNEP/SETAC في دورة الحياة لهدف إدخال المقارنات المتبعة في دورة الحياة إلى حالة النضوج. كانت هذه المبادرة في محور الجهود ل zostać الأدوات المتعلقة بدورة الحياة ذات القدرة على تقييم تأثير المنتج الثلاثية الأبعاد (البيئة، المجتمع، الاقتصاد). لقد ساعدت هذه المبادرة في جمع الموارد البشرية اللازمة لاستعمال الأدوات المتوفرة من خلال الشبكة الدولية لممارسي دورة الحياة التي هي في توسع دائم. ستستمر في السنوات القادمة المبادرات المتعلقة بدورة الحياة للعمل من أجل إدخال المقارنات المتبعة في دورة الحياة والأدوات اللازمة لدعم التحول إلى اقتصاد أخضر ضمن سياق التطور المستدام و استنصال الفقر.
ملخص تنفيذي

منذ القمة الأولى للتطور المستدام في ريو 1992، حصلنا تقدماً في مسألة موضوع عقب الإقتصاد العالمي على البيئة، أدى في بعض الأحيان إلى تقيقى هذا العبء. في حالة عدم إتخاذ إجراءات سريعة، سنواجه تحديات قد تجر الإنسانية نحو مطافات ذات عواقب مجهولة لا سيما فيما يتعلق بالمحافظة على المنظومات البيئية الهاشة، على عناصر الحياة البرية ووسائل الحياة الضرورية للإنسانية. في هذا الإطار وصدراً بشهير عاماً، اجتمع صانعي القرار وقادة الأعمال مجدداً في ريو دي جينيرو، لتقديم حالة البيئة والتقدم الحاصل لتأمين الرفاهية للشعوب الأكثر فقراً في العالم.

تتكون جذور المشكلة في الأنماط المساندة في طرق الاستهلاك والإنتاج غير مستدامة المماثلة لما كانت عليه منذ عشرين عاماً. إطعم، كساء، إيواء وتأمين المتطلبات والاحتياجات الأخرى لسكان العالم يتوقع قدرة وموارد الأرض المتاحة. قد يكون أكثر تعمقاً إيجاد الحلول المثلى الآن، إذ يلوح في الأفق تحدي تغيير المناخ، نقص المياه وتوسع قدرة الاستهلاك للطبقة الوسطى المتزايدة حول العالم.

أدت التعديلات والتجارب وثمن الضياع الدقيق لعملية حماية البيئة، من خلال القوانين والأنظمة، إلى تحسينات. إلا أن التحديات التي نواجهها تتعدى هذه الحول الجزئية من الوصفي أن الأسس التي يركز عليها النظام العالمي الحالي غير قابلة للاستمرار. لذا أحد أهم المواضيع التي سنتناولها قمة ريو هذه، هو ضرورة الإنتقال السريع إلى اقتصاد عالمي أخر، الذي ستمحور معظم المحتالات حول كيفية تشجيع ومساندة هذا التحول.

خلال العقود المنصرمين، أمن التفكير من خلال دورة الحياة قاعدة مبنية للمضى قدماً بجدول الأعمال. لقد تم تطوير أدوات ومكتبات في دراسة دورة الحياة، تلقى الآن رواجاً في القطاعين العام والخاص حيث
ОСНОВНЫЕ ПОЛОЖЕНИЯ

С момента первого Саммита по Устойчивому Развитию в 1992 году усилия направлялись, и в ряде случаев достаточно результативно, на снижение давления мировой экономики на окружающую среду. Однако, еще существуют проблемы, которые без принятия экстренных мер могут повлечь непредвиденные нарушения хрупких экосистем, популяций дикой природы и благополучия человека. В этой связи политики и деловые лидеры собираются снова в Рио-де-Жанейро, двадцать лет спустя, чтобы провести инвентаризацию проблем окружающей среды и оценить возможности обеспечения благополучия беднейшей части населения.

Суть проблемы, как и двадцать лет назад, обусловлена неустойчивостью существующих стереотипов потребления и производства. Пища, одежда, жилье и другие нужды и потребности населения сегодня превосходят доступные ресурсы и воспроизводственный потенциал природы. Поиск решений с приемлемыми рисками оказывается сегодня весьма затруднительным в условиях неопределенности изменения климата, сокращения доступности пресной воды и растущей интенсивности массового потребления средним классом.

Отдельные и специфические законодательные природоохранные меры на пути точечных усилий привели к некоторым улучшениям. Однако, современные вызовы далеко превосходят эти частные усилия и убеждают, что прежние принципы экономического развития более не приемлемы. Поэтому одна из важнейших тем этого Саммита концентрируется на необходимости быстрейшего перехода к принципам глобальной «Зеленой Экономики» и большинство обсуждений связано с поддержкой и стимуляцией такого перехода.

В последние два десятилетия методология жизненного цикла превратилась в концептуальный базис рационального развития. Появились и развиваются инструменты и методы жизненного цикла, находящие широкую частную и государственную практику и, в целом, уже создающие поддержку перехода к «Зеленой Экономике».

Соответствующие изменения уже происходят, создавая положительные сдвиги в продуктовых цепочках, стимулируя частные фирмы, и апробируются различными отраслями экономики, при этом затрагиваются как развитые так и развивающиеся страны.

Методология жизненного цикла представляет целостный подход, учитывающий воздействия продукции, начиная с ранних стадий, включая сырьевой этап, а также ее производство, потребление и заключительную утилизацию – т.е. от старта до финиша. При этом, менеджмент жизненного цикла представляет собой инструментариев для осуществления непрерывного совершенствования.

Инструментарий жизненного цикла предусматривает измерение, наблюдение и отчетность по воздействиям продукции как социального, так и экологического содержания, а также раскрывает воздействие на здоровье человека, что облегчает идентификацию наилучших и наихудших альтернатив для данного продукта. Такой подход предоставляет в распоряжение адекватную информацию тогда и там, где это необходимо для принятия правильных решений по охране окружающей среды, улучшению условий проживания и защите здоровья при эксплуатации продукции.

Освоение методологии жизненного цикла через интегрированные подходы имеет место одновременно как во множестве секторов, так и на различных уровнях. Существует уже много частных и государственных организаций, среди них – международные, средний и малый бизнес, города, региональные правительства, которые применяли для улучшения социальной и экологической обстановки методологию жизненного цикла.
Многие покупатели активно используют Интернет и доступную информацию от продавцов в своих решениях о покупках.

Ушло время, когда покупатели при своих решениях ориентировались только на цены. В эру глобальной информатизации проигрывают те производители, которые не отвечают информационным запросам потребления.

Инициатива UNEP/SETAC в части жизненного цикла продукции за последние десять лет уже достигла определенной зрелости. Она оказалась в центре усилий по развитию инструментария, обладающего потенциалом для целостного, охватывающего все три базовые составляющие, анализа воздействия жизненного цикла продукции. Это позволило объединить специалистов для разработки и апробации методологии жизненного цикла на широкой международной платформе, которая продолжает развиваться.
Перспективы развития Инициативы связываются с формированием доминирующей роли методологии жизненного цикла продукции при установлении принципов «Зеленой Экономики» в контексте парадигмы устойчивого развития.
SUMÁRIO EXECUTIVO

Desde a primeira Cúpula do Rio, sobre Desenvolvimento Sustentável em 1992, tem havido progresso no sentido de resolver e, em alguns casos, de reduzir a carga que a economia global coloca sobre o meio ambiente. Em outros casos, ainda enfrentamos desafios que, sem uma ação rápida, podem levar a humanidade para um caminho de consequências desconhecidas para a preservação de ecossistemas frágeis, para as populações dos animais selvagens e para os meios de sobrevivência humana. É neste contexto que os tomadores de decisões políticas e líderes empresariais se reúnem novamente no Rio de Janeiro, vinte anos depois, para fazer um balanço do estado do meio ambiente e do progresso para trazer prosperidade aos povos mais pobres do mundo.

A raiz do problema, como era há 20 anos, são os insustentáveis padrões vigentes de consumo e de produção. Alimentação, vestuário, abrigo e o suprimento de outros desejos e necessidades da população mundial excedem os recursos disponíveis na Terra e sua capacidade de suporte. A busca de soluções adequadas corre o risco de ser mais complicada desta vez com o fantasma da mudança climática, com o aumento da escassez de água e com a expansão do potencial de consumo de energia da crescente classe média global.

Medidas de ajustes e de sintonia fina para proteção do meio ambiente por meio de leis e regulamentos têm seguido uma estratégia de medidas pontuais, conduzindo a melhorias. Mas os desafios que enfrentamos estão esmagando estas soluções parciais – atualmente está evidente que as fundações sobre as quais o sistema econômico global se baseou não são mais viáveis. Assim, um dos principais temas a ser enfocado nesta Cúpula do Rio é a necessidade de uma rápida transição para uma economia verde global e muitas discussões serão direcionadas a como esta transição pode ser apoiada e estimulada.

Durante as duas últimas décadas o pensamento do ciclo de vida forneceu uma base conceitual para fazer a agenda progredir. Abordagens e ferramentas de ciclo de vida foram desenvolvidas e refinadas e são agora comuns nos setores públicos e privados e já estão estimulando e suportando a transição para uma economia verde global e muitas discussões serão direcionadas a como esta transição pode ser apoiada e estimulada.

O pensamento do ciclo de vida representa uma abordagem holística, examinando os impactos de um produto a partir de suas “humildes origens” como matérias-primas, através da produção, uso e disposição final – do berço ao túmulo. A gestão pelo ciclo de vida fornece uma metodologia para colocar o ciclo de vida em ação, rumo à melhoria contínua. As ferramentas de ciclo de vida medem, monitoram e comunicam impactos dos produtos, tanto ambientais quanto sociais e revelam os impactos sobre a saúde humana, permitindo que os produtos de melhor e de pior desempenho sejam mais facilmente identificados. Uma abordagem de ciclo de vida põe nas mãos dos indivíduos informações relevantes onde e quando eles necessitam, de forma que eles possam tomar boas decisões – para proteger o meio ambiente, para melhorar a qualidade de vida das pessoas que produzem os bens e para preservar a saúde das pessoas que os usam.

A mudança para o pensamento do ciclo de vida com uma integração de abordagens de ciclo de vida está ocorrendo em numerosos setores e em diferentes níveis, simultaneamente. Muitas organizações dos setores privado e público – multinacionais, PMEs, municipalidades, governos regionais, entre outras – já se comprometeram a melhorar seus desempenhos social e ambiental, adotando abordagens de ciclo de vida. Muitos indivíduos estão usando informação de ciclo de vida disponível em lojas e na Internet para tomar decisões de compras. Foi-se o tempo em que os consumidores percorriam as lojas e compravam na base apenas no preço. Na era atual, quando a informação é fundamental, aqueles que não fornecem a informação que seus acionistas, clientes e consumidores estão demandando, serão deixados para trás, como dinossauros a caminho da extinção.

A Iniciativa do Ciclo de Vida da UNEP/SETAC atuou durante a década passada de forma a contribuir para conduzir a abordagem de ciclo de vida e suas ferramentas correlatas, à maturidade. Ela tem estado no centro dos esforços para gerar ferramentas de ciclo de vida que tenham o potencial para fornecer uma repartição completa dos impactos dos produtos entre os três pilares da sustentabilidade. Ela tem auxiliado a manter ligados os recursos humanos para desenvolver e usar as ferramentas existentes por meio da rede internacional de praticantes do ciclo de vida, a qual continua se expandindo. Nos próximos anos a Iniciativa do Ciclo de Vida continuará trabalhando em direção das principais abordagens e ferramentas de ciclo de vida para apoiar a transição para a economia verde.
2002~2012：10年目のUNEP/SETACライフサイクルイニシアチブ

1992年にリオデジャネイロで行われた最初の持続可能な開発に関する地球サミット以来、世界の経済活動が環境に与える影響を考慮するための活動が行われてきました。そのいくつかは、環境影響を削減するために役立っています。しかし、脆弱なエコシステムや野生生物を保護し人間の生活を守るためにまだ行動をとれており、未知の結果に立ち向かう挑戦を続けているケースがあります。このような状況で、政策担当者やビジネス界のリーダーが地球環境の状態を評価し、世界的に貧しい人々の繁栄に向かっての進捗を検証するために、2020年に再びリオデジャネイロに集まります。

問題の根本は、20年前には、持続できない消費と生産のパターンが広がっていたことにあります。衣食住とその他の必要物の供給、並びに世界の人々の要求は、地球の利用可能な資源を超えており、気候変動の危惧、水資源の欠乏、世界の中流層の成長による消費力の拡大などと相まって、大きな課題が現在に至っており、危機的状況に直面しています。法律と規制で環境を保護することとは、ゲームの“ダーツ”のようなアプローチですが、時には改善に導いてきました。しかし、私たちが立ち向かっている挑戦は、これらの部分的解決策が単なる現在の状况を変えることが難しくなっています。したがって、リオデジャネイロでの地球サミットの主要なテーマの一つは、世界がグリーンエコノミーへ急速に変更することが必要であることを着目することです。また、この変更をいかに支援し鼓舞するかについて、多くの議論がさらになされるでしょう。

過去20年にわたって、ライフサイクル思考は議論を前に進めるための概念的な基礎を提供してきました。様々なライフサイクルアプローチとそのツールが開発され、改良されて、現在では産業界や社会で普通のことになっています。また既に、グリーンエコノミーへの変更を支援し、刺激しています。変化は既に現れ、全てのサプライチェーンに波状的に広まり、個々の企業を超えて、様々な産業へまた先進諸国と途上国の両者に広まりつつあります。

ライフサイクル思考は、製品の原材料である最初の一歩から、製造、使用、最終的な廃棄まで－ゆりかごから廃棄まで－製品の影響を考察する総合的なアプローチです。ライフサイクルマネジメントは、ライフサイクル思考を継続的な改善への活動にする方法を提供します。ライフサイクルツールは、製品の社会的な環境的な影響を測り、監視し、伝え、また、人間健康への影響を明らかにします。そして、最も良いまは最も悪いパフォーマンスである製品を簡単に特定できるようにします。ライフサイクルアプローチは、人がそれを必要とする時に、また必要とする場所で、重要な情報を人間の手に渡し、－環境を守り、製品を生産する人々の生活を改善し、それを使う人々の健康を守ります。

ライフサイクルアプローチを統合して使い、ライフサイクル思考へ移行することが、様々な産業や生活で、また様々なレベルで同時に起こっています。多くの企業や公共的組織－多国籍企業、中小企業、都市、地方自治体、その他の組織－で、ライフサイクルアプローチを採用して社会的な環境的なパフォーマンスを改善することが明言されるようになってきました。また多くの人々が、店舗やインターネットで利用可能なライフサイクルでの情報を製品購入の判断に使っています。消費者が店舗に行き、価格だけを頼りに製品を購入する日々は既に過ぎ去っています。情報が重要な現代では、ステークホルダーや顧客、消費者が必要とする情報の提供をする組織は、恐れが絶滅の道をたどったように、取り残されてゆくでしょう。

UNEP/SETACライフサイクルイニシアチブは、この10年間にライフサイクルアプローチとそれに関係するツールを完成させることを活発に支援し続けてきました。製品の影響のトリプルボトムラインを改善する可能性があるライフサイクルツールを生み出すことを中心に行ってきた。同時に、今も広がりつつあるライフサイクルで考え人々のネットワークを通じて、それらのツールを開発し使用するために必要とされる人的資源をもたらすことを助けけてきました。この先数年、ライフサイクルイニシアチブは、ライフサイクルアプローチとそのツールをグリーンエコノミーへの変遷の支援に組み入れる行動をさらに続けて行くことになるでしょう。
1. LIFE CYCLE THINKING IN CONTEXT – RIO+20 AND THE GREEN ECONOMY

Modern society imposes an enormous impact on the Earth. Indeed, it is often quoted that if the world’s inhabitants all consumed like those in the industrialized countries, it would require the resources of more than two Earths. As the world population continues to grow from 7 billion today to a predicted 9 billion in 2050, so too grows the need for natural resources to meet the water, food, clothing, shelter and other basic human needs of an additional 2 billion people. In addition, all the resources that we are harnessing in the name of goods and services production for humanity’s consumption all eventually end up as waste at some point and in some form, either to the air, water, or land. The Earth’s carrying capacity to absorb these wastes is being overwhelmed. With climate change looming, declines in biodiversity, growing water scarcity and other unresolved environmental issues already posing great challenges, it is clear that drastic change is needed.

Recognition of this future scenario was given as early as 1972 when the United Nations Conference on the Human Environment alluded to the unsustainable trends within our society due to “man’s capability to transform his surroundings”, referring to “incalculable harm to human beings and the human environment.” This dire warning was reiterated in the Rio Declaration on Environment and Development twenty years later, stating: “To achieve sustainable development and a higher quality of life for all people, States should reduce and eliminate unsustainable patterns of production and consumption…”

Fast-forward twenty years to the RIO+20 Summit taking place this year, and many approaches to environmental protection continue to be based on end-of-pipe solutions, focused on a single medium (e.g. air, water, soil), a single stage in the product’s life cycle (e.g. production, use, disposal), a single issue (e.g. individual chemical aspects) or a single sustainability dimension (e.g. environmental). These strategies do not always lead to socio-economic benefits and an overall reduction in environmental impacts, nor can they solve the problem of the additional resources needed to provide for the burgeoning global population. On the contrary, these strategies are generally attributed with merely shifting the burden of impacts.

Green Economy

One of the main themes of the RIO+20 conference, “a green economy in the context of sustainable development and poverty eradication”, is proposed as a key strategy to improve the compatibility between the increasing resource needs of the growing population and the Earth’s dwindling natural resource stocks and carrying capacity.

UNEP defines a green economy as one that results in “improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities.” In its simplest expression, a green economy is low-carbon, resource efficient, and socially inclusive. In a green economy, growth in income and employment are driven by public and private investments that reduce carbon emissions and pollution, enhance energy and resource efficiency, and prevent the loss of biodiversity and ecosystem services.

To put the green economy into practice, society must put in place strategies and supporting programmes to encourage the following actions:

1. Re-design products and/or business models so that the same functionality can be delivered with fundamentally less use of materials and energy.
2. Substitute green inputs for brown inputs wherever possible.

3. Recycle internal process wastes, including wastewater, high temperature heat, back pressure, etc.

4. Introduce new, cleaner technologies and improve the efficiency of existing processes to leapfrog and establish new modes of production that have a fundamentally higher material- and energy efficiency.

5. Redesign systems, especially the transportation system and urban infrastructure downstream, to utilize less resource-intensive inputs.

6. Invest in material, energy, and water efficiency, as well as in the transition to green jobs.4

Deciding which products to produce or procure, which process or technology investments to make, or which incentives and directives to implement that will most effectively contribute to a green economy will seldom be a straightforward task. Taking procurement as an example, many claims are made to describe how sustainable a product or service might be. However, all products have impacts – the ability to choose the one with the lowest negative impact requires credible and comparable information. Regarding the implementation of new directives, shortsighted decision making to address one issue may lead to unexpected consequences in other sectors, or may be to the detriment of societies in other countries. Such was the case when directives for e-waste recovery and recycling in some industrialized countries led large amounts of e-waste to be recycled under sub-optimal conditions in developing countries5 (see Section 5.5). Therefore, ensuring that proposed products, investments, incentives and directives contribute to a green economy, and ultimately to sustainable development, requires that these be analyzed in a way that goes beyond the single-issue focus to reveal a comprehensive set of environmental and social impacts.

If the green economy is to bring the necessary changes to guarantee a future for life on Earth, decision making on product sustainability, investment, and policy must be made using life cycle thinking and operationalized through life cycle management, approaches, and tools.

Life Cycle Thinking

Life cycle thinking is about getting reliable information about environmental, social and economic impacts into people’s hands at the time they are making decisions. It offers a way of incorporating sustainability into decision making processes and can be used by decision makers in both the public and private sector for the development of policies and products, as well as for procurement and the provision of services.

Life cycle thinking implies the understanding that materials are extracted from the earth, converted into process materials, combined with other materials to make parts, assembled into a finished product, shipped to customers who use the products and finally, the products are disposed of in some fashion. Along that value chain6, energy and other natural, social and economic resources are used, waste generated, and the related impacts, both positive and negative, are distributed across societies to varying degrees around the globe.

4 Ibid.
6 In ISO 26000 “value chain” means the entire sequence of activities or parties that provide or receive value in the form of products or services.
Looking at the industrial sector, life cycle thinking implies going beyond the more narrow traditional focus on an enterprise’s production facility. Life cycle thinking also means taking account of the environmental, social and economic impacts of a product over its entire life cycle (from raw material extraction through materials processing, manufacturing, distribution, use, repair and maintenance, and disposal or recycling) and value chain (Figure 1), from cradle to grave.

The main goals of life cycle thinking are:
1. to reduce a product’s resource use and emissions to the environment, and
2. improve its social and socio-economic performance throughout its life cycle.

By considering a life cycle perspective, governments, businesses and civil society can create products, deliver services, implement strategies, policy instruments, and/or incentives that can purposefully lead society down the path towards a green economy. A life cycle perspective broadens our understanding of where along a product’s life cycle lie the greatest opportunities for environmental, social, or economic impact reductions. This allows decision makers to make choices that anticipate and optimally avoid any potential shifts of the environmental burden to other phases in the life cycle, to other impact categories, to other social groups, or in our globalized economy, to other regions of the world. In some cases, this can also help safeguard the security and livelihoods of future generations.

**UNEP/SETAC Life Cycle Initiative Support for the Green Economy**

The UNEP/SETAC Life Cycle Initiative has worked on the development, proliferation and dissemination of life cycle tools and training of practitioners since 2002.

This publication has been produced especially for the occasion of RIO+20 World Summit on Sustainable Development in order to:

1. Demonstrate the great relevance and added value of life cycle thinking and approaches to the main theme of “transition to a green economy within the context of sustainable development and poverty eradication” taking place at the Summit.
2. Elaborate on the current status and key issues in the life cycle assessment field most relevant to the decision makers attending the discussions at RIO+20 and beyond.
3. Describe the significant contribution made over the past ten years by the UNEP/SETAC Life Cycle Initiative in developing the approaches and tools now commonly in use, and those under development.
4. Provide an introduction to, and invite all those interested in collaborating with, the UNEP/SETAC Life Cycle Initiative Third Phase of activities (2012-2017) as the Life Cycle Initiative moves the agenda forward towards a green economy.
2. MAKING LIFE CYCLE THINKING OPERATIONAL FOR ALL

There are many approaches, programmes and activities in the life cycle thinking basket that are essential in a green economy. These have been developed to assist in decision making at all levels regarding product development, production, procurement, and final disposal. They can be used in all sectors, and offer the possibility to examine a range of key impact categories (e.g. carbon footprint, water footprint, etc.), as well as the ultimate effects of these on all three key sustainability pillars (e.g. life cycle sustainability assessment).

Life Cycle Management, Approaches, Programmes and Activities

Life cycle thinking is made operational through Life Cycle Management (LCM). LCM is a management approach that puts the tools and methodologies in the life cycle thinking basket into practice. It is a product management system that helps businesses minimize the environmental and social burdens associated with their product or product portfolio during its entire life cycle. The LCM framework (Figure 2) describes a scheme where sustainability is achieved through the use of life cycle approaches, programmes and activities, and is supported by relevant and reliable datasets, as well as an appropriate policy framework (see message 4.2). The integration of LCM into business operations is similar to that of the ISO 9000 and 14000 standards in that it favours a cyclical plan-do-check-act approach, and thereby provides a basis for continual improvement.

Through LCM, enterprises can spur innovation towards improving the environmental performance and social benefits of existing products or services, or for the design of new green products (i.e. using design for environment). They can use products’ environmental improvements (i.e. measured through Life Cycle Assessment) to raise awareness and market green attributes (e.g. through Environmental Product Declarations). Companies can also optimize their product lines by phasing out or eliminating products that have demonstrated poor environmental performance. Taken together, these efforts can improve a company’s overall performance and profitability, strengthen company and brand credibility and stakeholder relations, and enhance shareholder value.

Read on and find insights and inspiration as to how life cycle thinking, management, and approaches are being developed and implemented in practice around the world.

In Retrospect:
What We Accomplished in Phase 1 and 2


This publication provides a series of key definitions and principles related to Life Cycle Management, a description of the importance and scope of intervention that different areas have in the organizations, and a step-by-step guide, adaptable to enterprises of any size, to support the integration of Life Cycle Management in the management process.

For illustrative purposes, it also contains twenty-one examples that describe how businesses are putting life cycle thinking into practice. http://www.unep.fr/scp/publications/details.asp?id=DTI/0889/PA
### 3. LIFE CYCLE THINKING IN ACTION

**Case Study: TIP Muebles** ([http://www.tipmuebles.com](http://www.tipmuebles.com))

<table>
<thead>
<tr>
<th>What were the life cycle based tools used?</th>
<th>La Unidad Comunal Forestal Agropecuaria y de Servicios (UCFAS) - Forest and Agricultural Community and Services Unit, manages a vertically integrated operation consisting of harvest, sawmilling, and its own furniture manufacturing plant and retail stores, TIP Muebles. Under a perspective of life cycle management, they have been certified for responsible forest management by the Forest Stewardship Council (FSC). They have also performed life cycle assessments in order to improve the design of their products and have sound environmental information that can be provided to different customers, for example the Public Green Purchasing programmes.</th>
</tr>
</thead>
<tbody>
<tr>
<td>To which product chain were the life cycle tools applied?</td>
<td>Wood and wooden furniture.</td>
</tr>
<tr>
<td>What were the benefits to the company from using the tools?</td>
<td>1. Improved process efficiency and selection of materials which has been reflected in economic benefits. 2. Better resource use by an improved collaborative ecodesign. 3. High value in the supply chain and in the community by knowing that the activities are thought to minimize environmental impacts. 4. The community is an active participant in each manufacturing activity of the wooden furniture and there are many capacity building activities around their involvement, their technical skills have improved as well as their knowledge and direct participation in improving the environmental conditions of their community. 5. Good accessibility to different markets, not only the Public Green Purchasing programmes. 6. Country recognition since the Initiative has been a finalist in the first “Iniciativa México Program 2010” which aims at identifying and recognizing projects and ideas with real social impact and with a strong commitment to a better future.</td>
</tr>
<tr>
<td>How did you use the information or other outcomes derived from using the life cycle based tools?</td>
<td>There have been different types of communication strategies. The outcomes derived have allowed providing important information on carbon footprint. The FSC logo is used in all communications and furniture. The information has also been used to sustain the claim that “TIP MUEBLES is naturally sustainable.” Internally it has provided meaningful information which has contributed to improved efficiency and capacity building in the supply chain.</td>
</tr>
<tr>
<td>What are the next steps in the company as regards the use of life cycle based tools and approaches?</td>
<td>Aiming at continuous improvement of the tools will support with information to guide strategic planning and also to keep moving in the Mexican market for a more informed consumer and if possible a furniture certification scheme that would allow more opportunities in Green Purchasing Programs.</td>
</tr>
</tbody>
</table>
## Case Study: Unilever

- **Measurement:** GHG footprinting (full life cycle); Waste (amount of pack and product that goes to landfill/litter); Water (in product and used by consumer).
- **Also:** champions network and innovation support tools.
- **Supply management:** sustainable agriculture code and Cool Farm GHG management and reporting tool.

### What were the life cycle based tools used?

<table>
<thead>
<tr>
<th>To which product chain were the life cycle tools applied?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1600 products in 14 countries representative of Unilever’s portfolio - foods and Home and Personal Care products.</td>
</tr>
</tbody>
</table>

### What were the benefits to the company from using the tools?

1. **Consumers want it.** A small but growing number of consumers around the world are seeking the assurance that the products they buy are ethically sourced and responsibly made.

2. **Retailers want it.** Many retailers have sustainability goals of their own and need the support of suppliers like Unilever to implement them. This collaboration is deepening the relationships we have with our customers.

3. **It fuels innovation.** Sustainability is a fertile area for both product and packaging innovation. It is allowing us to deliver new products with new consumer benefits. The brands which are building sustainability into their offer all performed well. For example, Lifebuoy, our concentrated liquid detergents and Comfort all grew to double digits in 2011.

4. **It helps develop new markets.** Over half Unilever’s sales are in developing countries, which often face the greatest sustainability challenges. New products that help people adapt to the changing world will drive growth.

5. **It saves money.** Managing our operations sustainably reduces energy, minimises packaging and drives out waste. The eco-efficiency programmes in our factories have continued to deliver good levels of savings.

6. **It inspires our people.** Our vision to create a sustainable, growing business is motivating for our employees and appealing to people who are considering joining Unilever.

### How did you use the information or other outcomes derived from using the life cycle based tools?

1. **We measure progress.** Our brand and functional teams all have sustainability scorecards. These are reviewed quarterly by the Unilever Leadership Executive. Yearly progress reports are posted on the Sustainable Living Plan web site.

2. **We are building sustainability into innovation.** We have a set of tools to evaluate the environmental impacts of new products.

3. **We are building expertise in behavior change.** Unilever’s Five Levers for Change methodology helps our brand and R&D teams design effective programmes.

4. **We communicate with the consumer in diverse ways (on packaging, in store, via our web site) to inform them how they can best reduce their environmental impact while using our products.**

### What are the next steps in the company as regards the use of life cycle based tools and approaches?

**We are starting to link progress to reward.** An increasing number of managers, from the CEO downward, have sustainability goals as part of their compensation. We are continuing to progress towards our 2020 targets through partnerships, innovation, and sustainable sourcing.
4. ABOUT THE UNEP/SETAC LIFE CYCLE INITIATIVE

The United Nations Environment Programme (UNEP), the Society of Environmental Toxicology and Chemistry (SETAC) and industry partners promote sustainable development thinking and practice in production and in general business strategies. Sustainable development objectives and a company’s bottom line come together in the important discussion of life cycle issues. With the publication of the ISO 14040 standard series dealing with LCA, UNEP and SETAC, aware of the need for dissemination and implementation, jointly began to work on the articulation of existing efforts around life cycle thinking and established the UNEP/SETAC Life Cycle Initiative (Life Cycle Initiative) in 2002. The partnership between UNEP, SETAC and public/private sector partners has the overall objective of promoting, assisting and supporting the use of life cycle thinking and life cycle approaches, including LCM, by companies and by their suppliers, customers and value-chain partners and by sponsors and partners of the Life Cycle Initiative with the purpose of furthering sustainable innovation and global trade of more sustainable products.

The Life Cycle Initiative is a response to the call from governments for a life cycle economy in the Malmö Declaration (2000). It contributed to the 10-year framework of programmes to promote sustainable consumption and production patterns, as requested at the World Summit on Sustainable Development (WSSD) in Johannesburg (2002). It aims to promote life cycle thinking globally and facilitate the exchange of knowledge of over 2,000 experts worldwide and four regional networks from different continents.

The Life Cycle Initiative’s activities to date have been carried out in two phases. The first phase (2002-2007) focused on establishing the Life Cycle Initiative as a global focal point of life cycle-related knowledge and activities, and building a community of practitioners and stakeholders. Activities to move the life cycle agenda forward concentrated on three important fields of work – life cycle management, life cycle inventory and life cycle impact assessment – and the cross-cutting area of social impacts along the life cycle. Phase 2 activities (2007-2012) saw the Life Cycle Initiative evolve to be more participative, encouraging more involvement from global stakeholders in order to achieve common understanding and agreement on tools and strategies being developed. The main outcomes of this phase were accomplished through close collaboration with key actors in the field. By engaging with experts and practitioners working in product policy, management and development, the Life Cycle Initiative provided support in the application of sustainability-driven life cycle approaches based on lessons learned from leading organizations.

It’s about people

A collage of photos demonstrating the work of the Life Cycle Initiative and its network. The international network of practitioners and stakeholders is a community of dedicated people.
The key deliverables of the Initiative’s Phase 1 and 2 activities are listed below, and are described in more detail throughout this publication as indicated.

- **Life Cycle Impact Assessment Framework:** Links a product’s environmental interventions or impacts to the ultimate effects on human health, ecosystem quality and resource depletion. (see Section 5.3)

- **USETox™:** An environmental model for characterization of human and ecotoxic impacts in Life Cycle Impact Assessment and for comparative assessment and ranking of chemicals according to their inherent hazard characteristics. (see Section 5.3)

- **Life Cycle Management:** Life cycle management provides a coherent methodology for implementing life cycle approaches and activities with the goal of continual performance improvement. (see Section 2)

- **Social LCA:** This framework sets out the key elements, indicators, and limitations for assessing the positive and negative social impacts of a product over its life cycle, with consideration of human rights, working conditions, health and safety, among others. This is a final key element that will enable a full triple bottom line approach to product sustainability assessment. (see Section 5.3)

- **Global Guidance Principles for life cycle assessment databases:** These principles give guidance for proper gathering and management of data, which enables better, more reliable life cycle assessment results and improves their use for decision making. (see Section 5.3)

- **Life Cycle Sustainability Assessment** – This framework brings together the two established product assessment tools of environmental LCA and life cycle costing with the newly developed social LCA to establish the process for a triple bottom line assessment of a product’s life cycle impacts. (see Section 5.4)

Building on the achievements and outputs of the previous two phases, the third phase (2012-2017) will focus efforts on contributing to the global mainstreaming of life cycle approaches (see Section 6 on p. 47 for more details on Phase 3). In summary, the Life Cycle Initiative is working to create the enabling conditions for:

- Enhancing the global consensus and relevance of existing and emerging life cycle methodologies and data management;

- Expanding capability worldwide to apply and to improve life cycle approaches making them operational for organizations;

- Communicating current life cycle knowledge and be the global voice of the Life Cycle community to influence and partner with stakeholders.
5. KEY MESSAGES FOR RIO+20 AND BEYOND

The UNEP/SETAC Life Cycle Initiative members and its network of stakeholders and professionals in the field believe that the transition to a green economy can only be successfully accomplished if the decisions made toward this goal are based upon solid, science-backed information. Life cycle thinking, through its many approaches and tools, helps to identify both the negative and positive consequences of decision making to the sustainability triple bottom line, thus enabling an appropriate weighing of options.

In support of this position, the Life Cycle Initiative has developed the following seven key messages targeted to the participants at the RIO+20 Summit. The messages describe the current state of use of life cycle approaches and tools, their beneficial qualities which support the transition to a green economy, and a glimpse into the future of life cycle approaches and tools, as well as how these will be supported by the Life Cycle Initiative’s Phase 3 activities.

There are many organizations, both public and private, around the world which have embraced life cycle thinking and are using it to map out their way forward to an improved environmental and social performance. Several have shown that they are leaders in the field, going an extra step to push the life cycle agenda forward, or to adapt life cycle approaches and tools at the core of their operations and activities. These ‘champions’ and life cycle ‘avant garde’ are profiled within the messages that follow to serve as an inspiration of what can be achieved, though they are by no means the only examples in existence.

We hope that these messages and examples will enlighten readers as to what can be gained through the adoption of life cycle approaches, instill confidence in the existing and upcoming tools that they provide a solid foundation for decision making, and ultimately, increase the momentum toward a greener global economy.
Many companies, both large and small, have realized that introducing sustainability into operations management makes business sense. Management trends today are now moving towards a true triple bottom line approach, supported by a mature, broad spectrum of life cycle approaches and tools that can be selected and tailored to examine specific issues or impact areas, and are supported by knowledgeable networks of stakeholders and professionals, reliable data and standardized methodologies. Using this approach, the ultimate goal of addressing the environmental impact of a product over its life cycle has changed. Before, the goal was to make it less damaging, whereas now, a potential goal is that it leads to an improvement of the environment. In addition, the application of life cycle tools has been extended to simultaneously consider social and economic aspects, thus providing an approach to measure changes to societal well-being and wealth.

Life Cycle Assessment – A cornerstone of Life Cycle Management

Life Cycle Assessment is a technique to assess the impacts – environmental or social – associated with the various stages of a product’s life, from raw material through use until final disposal. According to the ISO 14040 series, LCA is structured in four phases (Figure 3). Regardless of the type of LCA, the process of the assessment remains the same. Types of LCA include environmental LCA (E-LCA), social LCA (S-LCA), and life cycle sustainability assessment (LCSA). These are discussed more in messages 3 and 4.

Life cycle thinking that influences product design, strategic planning, procurement, and sales helps businesses:

- Enhance their image and the value of their brands – businesses can avoid criticism since responsibilities are better defined along the supply chain. Suppliers are made responsible for their own share of impacts as well as for corrective and preventive actions.
- Find new ways for marketing and sales departments to communicate and interact with customers – a company can promote its products and services supported by positive social and environmental claims derived from an impartial and science-based approach.
- Share life cycle information with suppliers, customers, and waste handlers to identify risks and opportunities for improvement – the risks might relate to the environment, human health, safety, or finance. Opportunities here include increasing market share, improved brand image, more effective use of materials, and innovation, amongst others.

The private sector is incorporating life cycle thinking on many fronts, including:

- **Product development** (via design for environment, design for disassembly…)
- **Production** (via environmental and social life cycle assessment, carbon footprint, water footprint, material flow accounting, supplier codes of conduct, supplier audits…)
- **Marketing** (via use of eco-labels, social and environmental certifications and labels, environmental and/or social product declarations…)
- **Use** (via demand-side management, integration of monitoring and communication technologies into products to inform users on energy and water use, design for easy maintenance, product service system development, user training on environmentally friendly product use…)
- **Disposal** (via design for disassembly or compostability, participation in product recycling systems or product takeback programmes…)
- **Management** (via operational transparency through reporting on environmental, social, and sustainability

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greening the economy through life cycle thinking

For the most part, companies start with the use of some life cycle approaches and tools on a product-oriented or project-organized basis. For example, in Asia and Latin America the need and use of water and carbon footprints is increasing exponentially.

The next step is to broaden the integration of life cycle thinking on a ‘top to bottom’ basis, including internal policies, management systems, accountabilities, and incentives – and at the same time, applying these elements wherever possible to yield improvements across the value chain (Figure 4).

There are some companies that are forging ahead by working with suppliers and supply chain issues towards continuous improvement as an important strategic consideration. Realizing that their future relies on “sustained profits”, these companies are taking bold steps forward to fully address the triple bottom line of sustainability (see ‘Avant Garde’ box).

In Retrospect:
What We Accomplished in Phase 1 and 2

Over the past decade of activities, the Life Cycle Initiative has helped to improve the understanding in the private sector of the benefits that can be derived from implementing life cycle methodologies and using the related tools within an environmental management framework. Workshops, study trips, and seminars brought together experts and stakeholders from many industry sectors (e.g. automotive, forestry, building and construction, electronics…) to share experience, and move the life cycle agenda forward in those sectors.

The Life Cycle Initiative produced several reports and guidance materials touching on most of the elements detailed in Figure 3 to support the uptake of life cycle approaches and the use of life cycle tools in the private sector, including:

- **Life Cycle Management – How business uses it to decrease footprint, create opportunities and make value chains more sustainable (2009)**
  A practical guide with eight case studies covering supply, production, warehousing, marketing, design and development. The key message: sustainability and the concept of life cycle management must be spread out along the value chain - both inside and outside the company. [http://www.unep.fr/scp/publications/details.asp?id=DTI/1208/PA](http://www.unep.fr/scp/publications/details.asp?id=DTI/1208/PA)

- **Capability Maturity Model (2010)**
  The Capability Maturity Model or Framework is about communication and training on the organization of life cycle management in global value chains. It shows how knowledge about product sustainability can be built up and disseminated among partners in the value chain. [http://supply-chain.unglobalcompact.org/site/article/45](http://supply-chain.unglobalcompact.org/site/article/45)

- **Water Footprint and Corporate Water Accounting for Resource Efficiency (2011)**
  A compilation of three documents providing an overview and analysis of water footprint assessment, a comparison of tools used for corporate water accounting, and a mapping of initiatives working to progress the public disclosure of water related information in the private sector. [http://www.unep.fr/shared/publications/pdf/DTIx1411xPA-WaterFootprint.pdf](http://www.unep.fr/shared/publications/pdf/DTIx1411xPA-WaterFootprint.pdf)
Looking Ahead To Phase 3

One can already find several good examples of enterprises that have seen the potential benefits of life cycle thinking and approaches, and are applying them to meet the expectations of their customers and consumers, and to meet their internal sustainability objectives. However, barriers to a broader adoption of life cycle approaches still remain to be overcome, for example for small and medium size enterprises (SMEs) and the emerging and rapidly growing economies.

One of the Life Cycle Initiative’s Phase 3 objectives is keyed toward mainstreaming the use of life cycle approaches. This implies the accessibility of cost-effective, robust methodologies and tools based on reliable data, with an availability of practitioners to apply them. Some of the many Phase 3 activities that will be implemented to this end include:

- Initiating a roundtable and holding workshops with stakeholders to develop consensus on consistent and comparable assessment frameworks where they are not yet available (i.e. product sustainability meta specifications).
- Broadening the sector specific life cycle knowledge by compiling results of existing studies and research, and using this to improve assessments in those sectors (i.e. through knowledge mining).
- Hosting workshops, training sessions, and developing educational materials on life cycle methodologies and data management for practitioners and stakeholders (e.g. capability building).
- Working with governments through a roundtable, workshops and networks to build capability and support for a consistent policy framework within which the private sector can apply life cycle approaches.

More details on the Life Cycle Initiative’s Phase 3 Flagship Project activities can be found in Section 6.

The ICC / BASD Ten Green Economy System Conditions

The International Chamber of Commerce (ICC), convener of the Business Action for Sustainable Development (BASD) at Rio+20, has developed and published the business and industry perspective on the transition to a green economy. The strategy paper cites taking a life cycle approach as one of ten essential building blocks of a green economy.

“System Condition #5 – A Life Cycle Approach”

A green economy adopts a life cycle approach which involves further minimizing the environmental footprint of all economic activity through applying science and acknowledging emerging knowledge. The life cycle of a product starts at raw material extraction, research on conceptual design and development of products and services, manufacturing, distribution, use and end of life treatment options such as recycling, recovery and reuse or remanufacturing. At every stage of the life cycle of a product, process, technology or service, critical questions about costs, benefits, environmental responsibility and social impact are being addressed. A life cycle approach also helps identify hidden opportunities and accounts for unintended consequences, spillover implications, and competition for resources.”

Life Cycle ‘Champions’
Private enterprises pushing the agenda forward

Around the world, companies are integrating life cycle thinking and approaches in a profound way, demonstrating their commitment to implementing sustainability in their operations and their products. Two Life Cycle Initiative publications, Life Cycle Management: A Business Guide to Sustainability (UNEP/SETAC, 2007) and Life Cycle Management: How business uses it to decrease footprint, create opportunities and make value chains more sustainable (UNEP/SETAC, 2009) reveal how leading companies have understood how life cycle management can be used to make value chains more sustainable and are applying it to create value.

Many examples exist, coming from both industrialized and developing countries, and from SMEs and multinationals alike. The Life Cycle Initiative continues to seek out examples of excellence in the application of life cycle thinking and approaches, and will profile them in future publications.

These two publications can be downloaded using the following links.

- Life Cycle Management: How business uses it to decrease footprint, create opportunities and make value chains more sustainable http://www.unep.fr/scp/publications/details.asp?id=DTI/0889/PA
5.2. Life Cycle Thinking in the Public Sector – Full of potential

With the start of the environmental movement in the 1960’s, governments have been called on to set the emissions frameworks within which business and organizations in general must operate. More recently, some governments have been working not only to set out the rules for others, but also to lead by example on sustainability in their own internal operations. Now, governments will be called on to make strategic decisions in order to establish the optimal conditions for the transition to a green economy within the context of sustainable development and poverty eradication that create neither unexpected nor unplanned consequences to society.

Procurement Leads The Way

Life cycle approaches are not new to the public sector, particularly in industrialized countries. Life cycle costing was used in the 1960’s by the US army to assess the full life cycle costs of investments in tanks and tractors. Since then, life cycle approaches and tools have been making inroads to address the environmental, and even the social side of government operations.

Public spending normally represents 8-30% of national GDP and every purchase is an opportunity to drive markets towards innovation and sustainability. Purchasing products and services that are “environmentally preferable” reduces the impact government operations have on the environment and supports regional and global markets for such products and services. This approach has matured since the 1990’s to the extent that green and sustainable public procurement strategies at the national, provincial/state and local level have been implemented in both industrialized and developing countries alike.

Sustainable Public Procurement (SPP) was identified in Agenda 21 and in Chapter III of the Johannesburg Plan of Implementation as one of the means to achieve sustainability. More recently, SPP was recognized as a priority theme for all regions as shown at the negotiations of the 19th Session of the Commission on Sustainable Development. SPP is also highlighted as a key “enabling condition” for a transition towards a green economy in UNEP’s green economy report. Through SPP, governments can lead by example and deliver key policy objectives in the environmental, social, and economic fields.

Beyond Procurement

Good examples of policies based on life cycle approaches are already in place. On the production side, pollution limits and cleaner production are typically supported by regulations and often by economic instruments, such as green taxes or emissions trading systems operating on a regional or international basis. On the product side, policies (in addition to sustainable public procurement noted above) have been put into place that encourage the development of green products, including ecodesign directives, or material recovery programmes. Extended producer responsibility regulations make producers responsible for their products from production through final disposal, and therefore, provide an incentive to develop products with improved environmental performance in all stages of the product life cycle. Regarding policy measures to support a shift to renewable energy, some countries encourage the installation

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of renewable energy capacity by offering premium feed-in tariffs for solar generated electricity.

However, these examples could be described as a dartboard approach, addressing individual issues with specific policies and tools. There are some forerunners in the public sector that have seen the benefit to be gained from going beyond the dartboard approach, toward fully integrating a life cycle perspective into all areas of government operations and policy (see ‘Avant Garde’ box). The bold steps taken by these public authorities will yield dividends for the sustainability of their constituencies and stakeholders, and will be the ones to watch as lessons are learned from their progress.

Enabling Life Cycle Approaches

There are several measures that can be taken by governments at all levels to create an enabling environment for life cycle thinking and approaches to gain a foothold, and help to set the course for the transition to a green economy.

First, governments can support data gathering and information sharing on the state of the environment, ecosystems and biodiversity, as well as for social indicators. Going further, an assessment of the wide range of environmental and social impacts of upcoming policies from a life cycle perspective can help to identify priority impact areas, and provide the knowledge required to avoid decisions that may undercut environmental conservation and social well-being.

Second, when sub-national or national governments design policies, negotiate voluntary agreements with industry, or decide where to invest resources, life cycle thinking can apply. Measuring potential life cycle impacts of decisions can help governments to:

- Inform government programmes and help prioritize these programmes, based on life cycle information.
- Make policies more consistent among consumers, producers, material suppliers, retailers, and waste managers and also among different policy instruments.

Life Cycle ‘Champion’

Life Cycle City: Tacoma, Washington, USA

In January, 2011, the city of Tacoma, Washington voted on an historical resolution. The city council adopted resolution 38188 making Tacoma the first city whose processes and operations are based on a life cycle perspective.

The resolution is ground-breaking in two ways. First, it recognizes the benefits of life cycle perspective for cities stating:

- Life cycle thinking and assessment offer a strong scientific basis to ensure that the desired environmental outcomes of city actions are achieved;
- Life cycle data substantiates the benefits of using cleaner utilities for business operations;
- Environmental product declarations can create a competitive advantage and showcase life cycle performance opportunities for companies in the City,

Second, the resolution thus commits the city to:

- Integrate life cycle assessments and principles in its relevant purchases and operations;
- Maintain and provide ongoing life cycle inventory data for its utility operations;
- Education for city employees in life cycle thinking and principles;
- Work with higher education and community partners to increase citywide capacity for life cycle thinking and support regional efforts;
- Support life cycle assessments and thinking in its relevant legislative and management decisions and will encourage public and private entities in the city to do the same.

Tacoma has followed up the life cycle city resolution with one that defines and recommit its to sustainability. In sum, the new resolution states that sustainability will guide and inform policy, that goals and targets in specific sustainability sectors will be established and monitored, and progress communicated to stakeholders.

These two resolutions, by embracing sustainability based on life cycle thinking and life cycle assessment, show the way forward for local authorities around the world.

For more information: http://iere.org/life-cycle-cities.aspx
(such as harmonizing regulations, voluntary agreements, taxes, and subsidies).

- Promote pricing products and services to accurately reflect the costs of environmental degradation, health problems, erosion of social welfare, and impacts at other life cycle stages. Such “price signals” can send messages to consumers and provide incentives for businesses to continuously improve the environmental and social performance of products or services, across each stage of the life cycle.

- Introduce policies that support take-back systems to establish a recycling-based economy according to the hierarchy reduce, reuse and recycle.\(^\text{10}\)

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**Life Cycle ‘Avant Garde’**

*Selected national or regional directives demonstrating close linkages to life cycle thinking / approaches*

Many countries are implementing directives that are based on life cycle thinking and integrate the use of life cycle approaches and tools. Some of these are noted below with links for further information, as well as additional examples, in Annex 1. This list is not meant to be exhaustive, but paints a broad picture of how life cycle thinking is being applied by the public sector. The Life Cycle Initiative continues to seek out and document examples of excellence in the application of life cycle thinking across the globe by governments at all levels.

- **EU:** Eco-design Directive (of Energy-Using Products) // **SWITZERLAND:** Biofuels Life Cycle Assessment Ordinance // **BELGIUM:** L’analyse des coûts du cycle de vie (ACCV) dans les marchés publics (durbles) // **FRANCE:** Affichage Environnemental // **JAPAN:** Legislative Framework for creating a Society based on 3R (Reduce, Reuse, Recycle) // **USA:** Pollution Prevention Act // **CHINA:** Circular Economy Law // **COSTA RICA:** Estrategia Nacional de Cambio Climático // **MEXICO:** La Estrategia Nacional de Producción y Consumo Sustentable // **NEW ZEALAND:** Waste Minimization Act
In Retrospect:
What We Accomplished in Phase 1 and 2

• In support of the public sector taking on life cycle perspectives, Life Cycle Initiative organized the Third Chinese Roundtable on Sustainable Consumption and Production with a focus on Life Cycle Assessment (LCA) and Life Cycle Management (LCM). The participants represented international organizations, Chinese national and local government agencies, Chinese companies from different industry sectors including minerals & metals, building & construction and ICT, and research institutes, from China and overseas. http://www.unep.fr/scp/marrakech/consultations/national/pdf/Beijing_%20SCP_Roundtable_Report_Nov2009_final.pdf

• Joint efforts were initiated with UN activities such as the Marrakech Process, the Sustainable Building and Construction Initiative and SAICM in order to inform decision makers about life cycle approaches.

• Eight Salient Points for Decision-Makers (2011)
The following set of points for reflection were first presented at the High- Level CSD Intersessional Meeting on a 10-Year Framework of Programmes on Sustainable Consumption and Production (13-14 January 2011, Panama City, Panama). The publication was addressed to government officials present at the meeting and called on this audience to remember (here, they are slightly modified from the original presentation):

1. Every product – along its supply chain, during its use, and it is disposed of - causes impacts on ecosystems and society.
2. Ecosystems – upon which all life on Earth relies – are affected in many different measureable and immeasurable ways.
3. Since all life is connected, ultimately, all environmental impacts affect humans.
4. By identifying and quantifying impacts, they can be understood and be managed.
5. Companies’ and governments’ policy and management decisions must be based upon which environmental and social impacts are most important and which should be addressed first.
6. When making sustainability decisions, the entire life cycle including trade-offs must be considered.
7. The frameworks upon which life cycle assessment and life cycle costing are based are the only techniques for identifying and quantifying the impacts (environmental, social, and economic) of products and their potential trade-offs, that are in line with the ISO 14040 standard.
8. Proper management of products’ impacts along their life cycle helps to preserve and improve the world’s ecosystems, and therefore reduce the impact on humans.

Looking Ahead To Phase 3

Government implementation of life cycle approaches takes place in the policies it puts in place and activities it undertakes. The good examples cited in this section show that this is taking place in different ways, following both a targeted approach (i.e., with focus on climate change, waste management, ecodesign, etc.) or as an underlying guiding principle (e.g., Tacoma Life Cycle City). These cases can be learned from and their lessons for success can be adapted to local conditions around the globe. This implies advancing a global understanding of life cycle thinking and approaches appropriate to the various levels of government, as well as knowledge of how methodologies and tools can be made more applicable to local conditions.

The Life Cycle Initiative’s Phase 3 activities will move the agenda in the public sector forward with a focus on capability development, including:

• Establishing the baseline of global life cycle capabilities which will be regularly updated to follow evolution and identify areas for additional efforts.
• Working with governments through a multi-stakeholder roundtable, workshops and with the cooperation of national networks to build capability on enabling policy approaches and the application of life cycle approaches within public programmes and activities.
• Translation of Life Cycle Initiative online materials into the official UN languages.
• Establishing and regular monitoring of relevant indicators on the effective application of life cycle based government policies.

More details on the Life Cycle Initiative’s Phase 3 Flagship Project activities relating to the public sector can be found in Section 6.
5.3. Life Cycle Methodologies, Assessment Tools, and Data – The foundation for informed decision making

Methodologies and tools are the working-level of life cycle thinking. They can be put into practice in many ways and to many ends. For those who are new to life cycle thinking, they may be surprised to learn that many thousands of individuals use life cycle tools daily in their decision making. Purchasing consumer goods while considering the water or energy use information provided by environmental product declarations (EPDs)\textsuperscript{11} is one way. Buying food while considering labels for certified organic produce and meat is another. Shopping for textiles and clothing while considering social and eco-labels is yet another.

Progress in making life cycle tools user-friendly with easy to interpret outputs is a result of years of data gathering and sharing, database development, refining of methodologies, and the development of appropriate means of communication. Accessibility has expanded from its debut in universities and research centres to one that is used daily by people of all ages and around the world via the internet. These on-line tools enable a personal water, energy, or ecological footprint to be derived and in so doing, allow the user to identify where the environmental (or social) impact of their consumption and lifestyle is the greatest.

The ease with which more involved assessments are undertaken has also benefitted from developments over the past decade. With the right tools, life cycle ‘screens’ can be completed within several hours. Quick studies can take several days. Larger assessments can take up to several months, depending on the need for new data collection. Once main operations are modeled, studies can be performed quickly.\textsuperscript{12}

However, with the large number of methods, labels and calculators now available, there is a risk of confusion of which one is best to use for decision making. It is therefore important that methods are harmonized to generate assessment results that are consistent, comparable, and transparent. Also, one can note certain limitations in some widely available tools that in the incorporation of locally relevant data is often limited.

\textsuperscript{11} See 5.7 for more information on EPDs.


Life Cycle Assessment Tools

Comparing footprinting to life cycle assessment

Footprinting tools (e.g. water, carbon or ecological) provide a fast and easy way to give an impression of environmental impact, but do not always follow standardised methodologies according to ISO, meaning that different tools can yield differing results. The GHG Protocol developed by the WRI and WBCSD (see box, next page), is currently the most used and acknowledged carbon footprint methodology. Their collaboration with the ISO TC 207 working group on carbon footprinting will contribute to harmonized methodologies being used worldwide, and the possibility of more robust and comparable results.

Life-cycle-based methodologies and tools used by enterprises and governments can be more comprehensive and be used to measure not only the environmental impacts, but also the social and economic impacts of their products and policies. The comprehensive range of these tools is necessary due to the scale of the potential consequences if wrong decisions are made.

Environmental Life Cycle Assessment (E-LCA)

E-LCA is a time tested assessment technique that evaluates environmental performance throughout the life cycle of a product or from performing a service. The extraction and

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure5.png}
\caption{Life cycle impact assessment midpoint-damage framework}
\end{figure}

consumption of resources (including energy), as well as releases to air, water, and soil, are quantified throughout all stages. Their potential contribution to environmental impact categories is then assessed. These categories include climate change, human and eco-toxicity, ionizing radiation, and resource base deterioration (e.g. water, non-renewable primary energy resources, land, etc.). The Life Cycle Initiative played a key role in the development of the life cycle assessment midpoint-damage framework (Figure 5), which conceptualizes the linkages between a product’s environmental interventions and their ultimate damage caused to human health, resource depletion and ecosystem quality – information which is of critical importance to decision makers.

Social Life Cycle Assessment (S-LCA)

Increasing media and consumer attention is being paid to work conditions and treatment of workers in certain global supply chains, and enterprises both large and small around the globe are seeking to establish clear and positive records on their corporate social responsibility (CSR). The first step to managing this issue is an assessment of the social implications of a product’s life cycle through a social life cycle assessment (S-LCA). S-LCA addresses issues of human rights, health and safety, and governance, among others, while also taking into account the utility of the product. The Life Cycle Initiative has been at the forefront of efforts to develop the S-LCA methodology, culminating with the publication of the “Guidelines for Social Life Cycle Assessment of Products” in 2009.

Linkages to other Tools and Techniques

Other tools that can be used in combination with life cycle assessment to assess more specific issues, phases or impacts of a product’s life cycle include, for example:

- indoor exposure assessment
- material flow accounting
- risk assessment

Crunching the Numbers

The phrase, “Information is power, as long as it is current” has a great deal of relevance to the data used in life cycle assessments. If an LCA’s conclusions are to be

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Life Cycle ‘Avant Garde’
GHG Protocol developed by the WRI and WBCSD

The Greenhouse Gas Protocol (GHG Protocol) is the most widely used international accounting tool for government and business leaders to understand, quantify, and manage greenhouse gas emissions. The GHG Protocol, a decade-long partnership between the World Resources Institute and the World Business Council for Sustainable Development, is working with businesses, governments, and environmental groups around the world to build a new generation of credible and effective programmes for tackling climate change.

It provides the accounting framework for nearly every GHG standard and programme in the world - from the International Standards Organization to The Climate Registry - as well as hundreds of GHG inventories prepared by individual companies.

The GHG Protocol also offers developing countries an internationally accepted management tool to help their businesses to compete in the global marketplace and their governments to make informed decisions about climate change.

Since the publication of the first edition of The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (Corporate Standard) in 2001, more than 1,000 businesses and organizations worldwide have developed their GHG inventories using the GHG Protocol. Some of the world’s largest companies are using the GHG Protocol’s Corporate Standard. The 2007 Corporate Climate Communications Report of the Fortune 500 companies by CorporateRegister.com reported 63 percent of companies use the GHG Protocol. The Carbon Disclosure Project - a non-profit organization that represents investors with assets totaling $41 trillion worth - regularly surveys the world’s largest companies to assess investment-related risks and opportunities related to climate change using the GHG Protocol as the framework. In 2008, 72 percent of Fortune 500 companies responded to the survey.

The 2010 GHG Workforce Survey from GHG Management Institute and Sequence Staffing found that the overwhelming majority of respondents said GHG Protocol is the second most important climate programme after Kyoto Protocol in the successful measurement and management of climate change.

Adapted from: http://www.ghgprotocol.org/about-ghgp
considered valid, the assessment needs to be based on data that is both recent and reliable, and the data needs to be available for all the various component parts and stages of a product’s life cycle. On the input side, LCA databases provide fundamental energy, materials, land, and water consumption data. The output side comprises data on emissions into water, air, and soil for a wide range of processes, products, and materials. Given the millions of products and services in use today, the rate at which new ones are being developed, the different methods of production, as well as the technical differences in play, robust data gathering is a challenge.

**Life Cycle ‘Champion’**

Prof. Dr. Olivier Jolliet: Long-time life cycle practitioner, teacher, innovator, and co-publisher of the USEtox tool

When it comes to life cycle assessment tools and methodologies, “keep it cleverly simple” is the mantra that Olivier Jolliet has employed, which has allowed him to make his mark and continue innovating for over 20 years as a practitioner and as a teacher. This principle helped to kick-start his career when he developed a software that could calculate energy consumption in greenhouses with the same accuracy, but in a fraction of the time typically required by the software commonly in use. As a life cycle practitioner, he has employed it to create tools, models and methodologies that have become the world standard. One of several examples that one could draw upon is the USEtox tool, launched in 2008 (1), which he co-developed with six others under the auspices of the Task Force on Toxic Impacts within the UNEP/SETAC Life Cycle Initiative.

In 2003, at the beginning of the process, there were several ‘competing’ models assessing chemical impacts. The task was therefore to derive one consensus model that could consistently and accurately identify the impacts of chemicals on human health and ecosystems. The first step was to compare the existing models, which identified their crucial differences and best aspects. Keeping it cleverly simple, Dr. Jolliet and the international team (2) worked to develop a parsimonious (as simple as possible but as complex as needed) and transparent consensus model that contained only the most influential elements. Covering more than 2000 substances, USEtox now provides a means to compare the impact per kg emitted substance on (urban) air, freshwater and agricultural soils, and how these ultimately affect human health. Dr. Jolliet notes with pride that the USEtox tool has now taken on a life of its own – users are adapting it to their needs, expanding on the tool to incorporate new aspects. By establishing a formal ‘community of users’ and holding monthly open webinars, he hopes that all USEtox users will be able to capitalize on the new ideas being introduced and incorporated.

However, Dr. Jolliet cites the experience of arriving at a consensus as a further positive outcome of the group’s work, and that it now provides a model process that can be used in the development of other life cycle tools. The enormous volunteer effort provided himself and the other group members and the openness with which they approached the work demonstrates the commitment to a collaborative work ethic and environment that he has fostered within life cycle practitioner circles.

His collaborative approach has led him to many other seminal achievements including:

- Definition of the term “Intake Fraction” (i.e. the fraction of an emission which is taken in by the population) (3), and derivation of the Product Intake Fraction concept, both fundamental to life cycle assessment models.

- Measurement of the health impact related to the consumption of goods, through overlaying a world economic model with a world health impact assessment model. For example, the model can estimate the amount of health impact from particulate matter in Asia derived from the production of goods sold in America.

Looking back, it was a letter to Jacqueline Aloisi de Larderel from himself and Prof. Helias Udo de Haes in 1999 that started the ball rolling toward the establishment of the Life Cycle Initiative. His work continues to support the Life Cycle Initiative’s goal of bringing life cycle approaches and tools into the mainstream.

**Notes**


(2) The international team that developed the USEtox Tool: Michael Z. Hauschild, Technical University of Denmark (DTU); Mark Huijbregts, Radboud University (The Netherlands); Olivier Jolliet, University of Michigan Ann Arbor; Matt Macleod, ETH Zurich (Switzerland); Manuele Margni, École Polytechnique de Montréal (Canada); Dik Van de Meent, National Institute for Public Health and the Environment, (RIVM; The Netherlands); Ralph K. Rosenbaum, École Polytechnique de Montréal (Canada); Thomas E. McKone, Lawrence Berkeley National Laboratory and University of California Berkeley.

In Retrospect: What We Accomplished in Phase 1 and 2

The Life Cycle Initiative, with the tremendous dedication of its task force members, has been able to expand the variety and robustness of methodologies and tools, and consolidate international consensus around them (e.g. the USETox assessment method, social LCA, etc.). In addition, gaps and limitations of LCA tools and techniques have been explored and addressed, also with international acceptance (e.g., life cycle impact assessment framework including climate change and ozone depletion impacts).

The deliverables have focused on life cycle data, the impact of chemicals, the development of the social life cycle assessment framework, and life cycle costing as a part of the broader life cycle sustainability assessment. Publications derived from these activities are noted below.

  For the past two decades, databases have been developed, maintained, and updated by different general database providers, by academics and researchers, by industry sector database providers, and by industry internal groups. This guidance for database development will help to ensure useful, robust life cycle assessment results and comparability between assessments done in different regions of the world. It represents a milestone in the harmonization of how datasets are developed and how life cycle assessment databases are created, managed and used in an interoperable and transparent manner by LCA practitioners worldwide. http://www.unep.org/pdf/Global-Guidance-Principles-for-LCA.pdf

- USETox™ assessment method (2009)
  The Life Cycle Initiative led the way to reaching a global consensus on a life cycle toxicity assessment method named the “USETox™ model”, which allows companies to understand the potential toxicity of products. Also see ‘Life Cycle Champion’ box. http://www.usetox.org

  S-LCA expands on the traditional life cycle assessment methodology to focus on the social impacts of a product’s life cycle. This publication helps decision makers to better understand and track the implications of the consumption and production of products over their life cycle in terms of impacts on the quality of work and life of people in both developed and developing economies. http://www.unep.fr/shared/publications/pdf/DTIx1164xPA-guidelines_sLCA.pdf

  This publication provides an introduction to Life Cycle Costing (LCC) and illustrates its applications. In combination with environmental life cycle assessment and with current research in social LCA, LCC moves us closer to a more robust sustainability assessment. This book provides explanations, examples, and case studies that offer significant steps toward achieving that goal. https://www.setac.net/setacssa/ecssashop.shopping_page

Looking Ahead To Phase 3

Work to build up and consolidate support for the existing and newly developed methods and tools will continue in Phase 3. New methods currently under development include a footprinting tool that addresses chemical use and a framework to assess impacts of water depletion (Jean-Baptiste Bayart et al, 2010) and land use on biodiversity and ecosystem services is at the early stage of testing.

Another exciting new assessment framework under development and in the testing stage is Life Cycle Sustainability Assessment (LCSA) of products. LCSA is described in more detail in Message 5.4.

In addition, given the critical importance of databases to relevant and robust life cycle assessment results, the Life Cycle Initiative has identified the need to engage with the global network on database development. Here, the focus will be to communicate the global guidance principles, support the development of new databases and catalogue the existing ones, and roll out training and technical assistance.

More details on the Life Cycle Initiative’s Phase 3 Flagship Project activities relating to the development and mainstreaming of methodologies and tools can be found in Section 6.
5.4. Life Cycle Sustainability Approaches – Measuring triple bottom line impacts

In addition to tackling economic questions when developing policies and strategies, or products and services, governments and enterprises are under increasing pressure to consider impacts on the environment and society. The growing societal concern with addressing the three pillars of sustainability (i.e. environment, economic, and social) requires that appropriate tools are available to inform decision making. Up to now, environmental LCA and life cycle costing have been applied to effectively assess the environmental and economic aspects.

One key objective of the Life Cycle Initiative is to help extend LCA methodologies beyond their original scope of identifying and assessing resource consumption and environmental interventions associated with products or processes. LCA can be extended in many ways (see message 5.3), and one major advance that has been fostered by the Life Cycle Initiative has been the elaboration and fusion of methods and techniques that together can measure sustainability, thus allowing LCA to support decision making toward more sustainable product and process systems. The synthesis of these methods and techniques has resulted in the elaboration of the life cycle sustainability assessment (LCSA) framework.

LCSA contributes to the discussions at Rio+20 as a methodology with a great deal of potential to provide a combined sustainability indicator of a product or process by combining environmental life cycle assessment (E-LCA), social life cycle assessment (S-LCA) and life cycle costing (LCC) in a coherent framework (see Figure 6). The benefits of a simultaneous assessment of the three sustainability

Figure 6 - Presentation of LCSA results of a marble slabs study

pillars in one tool, as opposed to using three separate tools are numerous:

• Helps clarify the trade-offs between the three sustainability pillars, life cycle stages and impacts, products and possibly, generations (see Section 5.5).

• Implies the ability to reduce environmental degradation and the use of natural resources in a cost-effective manner, while at the same time contributing to social welfare.

• Promotes awareness on triple bottom line sustainability issues in value chain actors.

• Supports enterprises and value chain actors in identifying weaknesses and enabling further improvements of a product life cycle.

• Supports decision makers in prioritizing resources and investing them where there are more chances of positive impacts and less risk of negative ones.

• Helps decision makers choose sustainable products and technologies; consumers will not only know which products are more cost-efficient, eco-efficient or socially responsible, but also more sustainable.

• Provides guiding principles to achieve sustainable consumption and production.

**Life Cycle ‘Champion’**

**Daniel Goleman - internationally known psychologist and bestselling author of Ecological Intelligence: How Knowing the Hidden Impacts of What We Buy Can Change Everything**

In his book published in 2009, Ecological Intelligence: How Knowing the Hidden Impacts of What We Buy Can Change Everything, Daniel Goleman extends his treatises on intelligence to address the ecological challenges we face as a human civilization. In it, he looks at how ecological intelligence, combined with marketplace transparency, can create a mechanism and driver for positive change.

Goleman identifies the industrial revolution and the globalized economy as the reason for which humans have become estranged from knowing the immediate impacts of their lifestyles. Since most of the products we consume are generated and disposed of in places other than where we live, we don’t see the consequences of our consumption, and this disjoint has diminished our collective ecological intelligence over the last century. He elaborates on the ‘information dissymmetry’ that exists between what producers know about the ecological impacts of their products and what consumers are told at the point of purchase, which further hinders informed decision making. To overcome this, he advocates a “radical transparency, the laying bare of a product’s ecological impacts for all to see.” This transparency is based firmly on environmental and social life cycle assessments of products using good quality information, combined with clear communication on the impacts, optimally given right on the price tags of the goods. Goleman notes that there are already some web-based tools that are taking the lead to chip away at this information dissymmetry (see web sites below).

Goleman also describes that some companies are looking beyond the gates of their production plants to discover the impacts throughout the product value chain. These companies are turning to life cycle assessment (e.g. Coca-Cola to measure water consumption, or Procter & Gamble to measure impacts across several product lines) to first, understand where the key impacts are occurring and second, to take steps to reduce the identified impacts. He notes that these are the first steps to integrating sustainability into operations.

His book and the many examples he provides give hope that the typical resistance and denial responses to environmental issues in the private sector is waning. They provide inspiration that a corner is being turned in how companies large and small are addressing the sustainability challenge, with life cycle assessment as the corner stone of change.

Sourced mainly from:


Product transparency web sites:

- Skindeep: ranks personal care products for potential toxicity (www.ewg.org/skindeep/)

- Goodguide: rates tens of thousands of consumer goods and foods (and the companies that make them) on their environmental, health, and social impacts (www.goodguide.com)
In Retrospect: What We Accomplished in Phase 1 and 2

The Life Cycle Initiative led the effort to develop this framework, resulting in the ground-breaking first publication:


  The aim of the publication is to support stakeholders looking for approaches that will provide holistic assessments of the implications of a product’s life cycle for the environment and society. The publication includes eight case studies that illustrate how current and emerging life cycle assessment techniques are being implemented worldwide. http://lcinitiative.unep.fr/includes/file.asp?site=lcinit&file=2EDD7BC7-E63F-432B-9119-8D20CDBF9A37

Looking Ahead To Phase 3

It is clear that more guidance on a number of methodological challenges and effort for capability development will be needed to fully operationalize and eventually mainstream LCSA in product development, marketing and decision making. More LCSAs must be carried out in order for lessons to be learned through experience, to overcome current limitations, to expand the available data, and improve techniques and methodology.

The Life Cycle Initiative is poised to play an important role in making this happen through its Phase 3 LCSA Flagship Project, including holding a variety of workshops that will lead to LCSA education materials, improvement of the LCSA methodology as well as guidance on its use.

More details on the Life Cycle Initiative’s Phase 3 Flagship Project activities relating to life cycle sustainability assessment can be found in Section 6.

**Life Cycle ‘Avant Garde’**

**Natura – A Brazilian Cosmetics company that has been pushing life cycle approaches in the field since 2001**

Since it was established in 1969, Natura Cosméticos – a leading cosmetic company in Latin America – has had a strong commitment to Sustainability, to the creation of value in the entire supply chain, and to the balance of economic, social, and environmental impacts. In line with these commitments, the company has launched initiatives to minimize its environmental impacts, such as the iconic example of refill packs, which have been available since the early 1980s. Concurrently, since 2001 several environmental indicators and associated management systems have been implemented in three waves.

The first model was a simplified Life Cycle Assessment for packaging - the calculated aggregated value in “millipoints” per kilo of content, characterized the relative environmental impact of packaging of each product, and helped initiate Ecodesign practices in the Development process. In addition, this indicator allowed for the calculation of an average value for all packaging of Natura’s products, considering the mass of sold products each month and year.

The second model launched in 2007, referred to as the Environmental Table, is included on the labels of all products and is specified on the company’s website. It is comprised of 6 indicators that describe the product content (specifying the source of the raw materials) and the packaging (% of recycled material, % of recyclable material and number of recommended refills). Its objective was to raise consumer awareness in relation to the environment. In addition, it increased the number of Indicators available for Sustainability Management purposes, by calculating the average value of these 6 parameters for all sold products.

The third model, which is related to Greenhouse Gas (GHG) Emissions, was initially created in 2007 as the basis for the Carbon Neutral Program. Natura’s externally verified Scope 3 Inventory counts the GHG Emissions of the entire supply chain, starting from the extraction of raw materials up to the disposal of products. This model was recently updated to include two additional levels: classification of the inventory per macro process and the carbon footprint of all products sold by the company. This system of indicators provides an even more effective support to the Carbon Reduction Program, which includes an ambitious 33% corporate reduction target (calculated in carbon intensity).

Other relevant environmental and social indicators are still being studied, to try and bring more LCA knowledge into business applications, with the ultimate objective of making Natura’s products and activities even more sustainable.

Sourced from Natura Brazil, *a Life Cycle Management experience in the cosmetic industry*. Fabien Bronès, Natura Cosméticos, Sustainable Technologies, São Paulo, Brazil.

More information: www2.natura.net/NaturaUniverse/En/src/index.asp
It has been proven time and time again that making decisions with a limited vision of a problem can be counter-productive, and in extreme cases, even take society in the wrong direction when unexpected consequences occur.

Trade-offs will always be a part of decision making, but when a life cycle perspective is considered, it expands the field of vision of the issue at hand. Looking up and down the value chain can help to reveal acceptable and unacceptable trade-offs, and may uncover otherwise unexpected consequences that could occur – in diverse stages of the value chain, to other sustainability pillars, to other societies, and so on. Because it is holistic, systemic and rigorous, life cycle assessment is an essential tool for generating information and broadening knowledge about potential and real impacts along a product’s life cycle, and thereby increases the possibility to improve overall product sustainability.

Potential trade-offs can be characterized in many ways, as described below.

a) Trade-offs between stages of the product value chain

From its humble beginnings as a raw material taken from the Earth, a product and its components can travel thousands of kilometers and be handled and used by hundreds or thousands of people before it reaches its final disposal phase. Similarly, a decision to use one raw material over another can have an impact on each link of the product value chain.

For example, consider a car made with lightweight composite materials as opposed to conventional steel. While the benefits of lighter automobile weight can translate into fuel savings in the use phase, the production and disposal or recycling of composite materials need to be assessed as well and compared to conventional steel production and recycling in order to truly know which will be more beneficial to society and the environment.

b) Trade-offs between environmental impact categories

Land, water and air are intricately involved in the human life cycle, as well as in the life cycle of products. Decisions made in the name of protecting one of these environmental ‘media’ can result in the detriment of another, and possibly lead to consequences for human health.

A classic example is MTBE (Methyl Tertiary Butyl Ether). MTBE is added to gasoline to increase octane levels and enhance combustion, which in turn reduces polluting emissions. MTBE in gasoline can reduce ozone precursors by 15%, benzene emissions by 50%, and CO emissions by 11%. While MTBE helps mitigate air pollution, the MTBE itself may be toxic if not combusted fully. MTBE is not considered highly toxic, but it has been banned for use in many US states. Of most concern is the MTBE found in lakes, reservoirs, and groundwater for potable water supplies. Levels of MTBE in the environment are now measured when MTBE is suspected to have evaporated from gasoline or leaked from storage tanks, lines and fueling stations.

c) Trade-offs between sustainability pillars – environmental, social, economic

In a green economy based on the principle that products and services should ultimately be to the benefit of the environment and society over their life cycle, the full costs of protecting the environment and appropriate conditions and treatment of workers must be considered. In other words, a product should be produced to the detriment of neither the environment nor the people participating in the value chain.
For example, the global textile and electronics industries have come under scrutiny for producing inexpensive clothing and electronic equipment to the economic benefit of several global enterprises and their consumers, while using inappropriate labour practices that are socially detrimental to the people working in the production of these items. In a contrasting example, organic farming may not only be less damaging to the environment when compared to conventional farming methods (e.g., regarding chemical use) it can also improve farmers’ working conditions and provide overall health benefits to society.

d) Trade-offs between societies / regions

In the globalized economy, product value chains are spread across countries around the globe. Decisions made to address an issue in one region can thus cause unexpected impacts in other parts of the world.

For example, with respect to electronic waste (e-waste), it could be said that “one person’s waste is another person’s gold” since electronics contain many valuable and recyclable materials (e.g., copper). The increasing popularity of electronic goods over the past two decades, and the rate at which new products are developed, has led to the creation of ever increasing amounts of e-waste to be recycled. However, acquiring the ‘gold’ from e-waste recycling has come at a high environmental and social cost in some developing countries.\(^\text{13}\) Directives for e-waste recovery and recycling in some industrialized countries led large amounts of e-waste to be recycled informally in developing countries under detrimental conditions for the environment and the people doing the recycling, due to releases of toxic materials in the process. New directives approved in the EU in 2012 have strengthened provisions against the exportation of e-waste.\(^\text{14}\)

e) Generational trade-offs

Sustainable development is about making decisions today that preserve the ability of future generations to meet their needs. The Native-American Ojibwe tribe recognized this, and as a principle, made their decisions considering, as much as possible, the lives of seven generations of children. In comparison, our current globalized economy, largely responsible for the state of the environment we live in today, typically considers a far shorter time span. Long-term business decisions are made for time periods of 10-20 years as a maximum, or, less than one generation.

A good example of this is the current debate over climate change and the fluctuating international commitment to reducing greenhouse gas emissions. Decisions made now are going to have an enormous impact, for better or for worse, on future generations and the stability of the climate in the future. In a contrasting example, we can see the positive result of the consideration of future generations in decisions made to address the holes forming in the Earth’s ozone layer. The result of the Montreal Protocol’s phase out of ozone depleting substances from consumer and industrial

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**Life Cycle ‘Champion’**

Jacqueline Aloisi de Larderel – UNEP’s Life Cycle Pioneer and First Chair of the Life Cycle Initiative Board

Jacqueline Aloisi de Larderel joined the United Nations Environment Programme (UNEP) in 1987 as the Director of the Industry and Environment Centre and assumed the position of Director of the newly created Division of Technology, Industry and Economics in 1998. She was particularly active in promoting environmental management tools and the cleaner production concept to prevent pollution and minimize the use of natural resources.

Mrs. Aloisi was essential to the creation of the Life Cycle Initiative to be hosted in UNEP, seeing life cycle thinking and tools as a key building block upon which product development decision making could be guided towards environmental improvement. She was chair of the LCI board until her departure from UNEP in 2003, during which time she oversaw the Phase I work programme such that the Life Cycle Initiative began to fulfill its role as a global catalyst for life cycle knowledge transfer, while fostering the use of life cycle thinking in government, industry, and consumer decision making, worldwide.

Mrs. Aloisi is currently a valuable and active member of the International Resource Panel where she continues to push the life cycle perspective as a guiding principle among the Resource Panel’s working groups. The recent work of the IRP includes a report on decoupling, which addresses the traditional tradeoff of increased environmental impact as a consequence of increased product and service consumption. See the ‘Avant Garde’ box for more information.

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\(^\text{13}\) UNEP. Recycling – From E-Waste To Resources, Final Report, July 2009

products has largely been seen as a success in securing the future of the ozone layer, and protecting human health and well-being for generations to come.\textsuperscript{15}

**In Retrospect:**

**What We Accomplished in Phase 1 and 2**

The Life Cycle Initiative engaged in developing life cycle practitioner capabilities in non-OECD countries while building and supporting global and national networks of practitioners and stakeholders. Greater national capability and knowledge is the foundation for ensuring that diverse perspectives and local information/data are considered in life cycle assessments and should allow trade-offs to be more readily identified, and unexpected consequences to be avoided.

Work with partners, such as the International Resource Panel has already resulted in ground-breaking work on *identifying the environmental impacts of consumption and production*, which pinpoints ‘hotspots’ such as agriculture and fossil fuel use where change is needed (see ‘Avant Garde’ box).


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**Life Cycle ‘Avant Garde’**

**International Resource Panel and the recently published “Assessing the Environmental Impacts of Production and Consumption”**

All economic activity occurs in the natural, physical world, and harnesses energy, materials and land. Economic activity also generates material residuals, which enter the environment as waste or polluting emissions. The Earth, being a finite planet, has a limited capability to supply resources and to absorb pollution. A fundamental question the Resource Panel is tasked to answer is how different economic activities influence the use of natural resources and the generation of pollution.

This report investigates which production processes, which material use, and which consumption clusters impose the greatest environmental impacts. It assesses the best-available science at the global level to identify priorities among industry sectors, consumption categories and materials, for both developed and developing countries.

What are the most important industries that cause climate change? How much energy do different consumption activities require when the production of the products is taken into account? What are the materials that contribute most to environmental problems? In answering these questions, the report follows the tradition of life cycle impact assessment and distinguishes between the following areas of protection:

- **ecosystem health**;
- **human health**; and
- **resource provision capability for human welfare**.

The results of the assessment set the following priorities, or hotspots that require attention:

- **Production perspective**: production processes involving fossil fuel use, agriculture and biomass using activities, fisheries.
- **Consumption perspective**: food, housing, mobility, manufactured products (particularly electrical appliances).
- **Materials perspective**: Fossil fuel extraction, agricultural materials (especially animal products), and, extracting and refining materials that are used for their structural or material properties.

5.6. Life Cycle Initiative Networks – Growing in numbers and expertise

The capability development efforts of the Life Cycle Initiative aim to empower individuals and societies with the necessary skills and competences to move our societies toward more sustainable production and consumption patterns. Together with our partners we are building networks, sharing knowledge, data, experiences and best practices, and implementing projects to foster a new generation of citizens who integrate life cycle thinking in their personal and professional decisions. Target audiences of our capability development activities include: (1) scientists, (2) business, (3) governments and the (4) civil society.

The International Life Cycle Network

One of the greatest successes of the Life Cycle Initiative’s ten years of existence has been the establishment of an international network of life cycle practitioners, currently with over 2,000 registered participants and continually growing (Figure 7). The successful establishment of the network has been based on a good understanding of the needs of the users of life cycle tools attained through surveys and stakeholder consultations. The network is now a self-sustaining entity, and supports the Life Cycle Initiative’s work plan by providing the needed body of experts to complete peer reviews, as well as being a source of input and consensus on new tools and guidance.

While the roots of life cycle thinking and expertise are found in Europe, the Life Cycle Initiative has worked with partner organizations to launch three regional life cycle networks in Africa and Latin America, as well as national networks in China, Argentina, Colombia, and the United States. New networks are also being built up in India, Russia and in some African countries (see map, p. 41). The core participants of all these networks are motivated believers in life cycle perspectives.

Life Cycle Jobs Are Green Jobs

Life cycle practitioners are in demand in a green economy. This has already been recognized by some countries, as described in the ILO submission to the RIO+20 Summit on how occupations change as an economy goes green. The report makes several references to need for life cycle assessment skills, for example, in the checklist of green skills identified by the UK government. In a further example, the Republic of Korea is noted to have created new ‘sector skills councils’, one of which provides training on sustainability assessment.16

In Retrospect: What We Accomplished in Phase 1 and 2

Phase 1 and 2 activities prioritized the strengthening of regional and international scientific networks worldwide. The network database now lists more than six times the number of entries since it debuted.

Another indication of the number of international life cycle stakeholders is the number of hits per month on the Life Cycle Initiative’s portal with online tools, which total more than 15,000. The Global Guidance for LCA Databases, the S-LCA and LCM training materials are the most downloaded documents. Materials are broadly used in developing economies and businesses around the world for internal training.

Projects to expand the network and develop life cycle capability included dozens of seminars, workshops and sessions at international conferences and meetings, particularly focusing in non-OECD countries. In addition, some projects targeted specific sectors or regions, for example, the Strengthening on Sustainable Resource Management in Latin America and the Caribbean project assessed the available resources in the region and established a network of 110 public officials and other relevant stakeholders. http://lcinitiative.unep.fr/sites/lcinit/default.asp?site=lcinit&page_id=FD2EE33D-6166-4F15-8C5A-13AA197A76B9

The “UNEP/SETAC Life Cycle Award” acknowledges the work from academics and private companies in developing and emerging economies who have started visionary and represented by Chile and Argentina and to be rotated amongst EC members every two years. To date, the EC has 13 members representing organizations, firms and individuals from a total of 9 countries plus the representative from the Secretariat of the UNEP-SETAC ILCI. This EC is the network’s higher authority, in charge of providing strategic guidelines as well as developing procedures and overall guidance for the network operation.

The Vision statement and the main goals reflect the aspiration to have governments, business and consumers at large applying life cycle approaches for better decision making towards a society, which controls and minimizes negative environmental impacts, and enhances social and economic achievement.

Amongst the several RICV projects, of particular interest is the soon to be finished project (2008-2012) on Life Cycle Inventories – energy sector for five countries in the region: Mexico, Peru, Argentina, Brazil and Chile. This project, beyond the specific findings and recommendations on LCIs, has worked on capability building and it adds efforts from international partners, thus, it also fosters experience exchange, global collaborative partnership and enhanced networking. More recently the pilot projects on GESRE also reflect the collaboration and successful networking activity the RICV achieves.

ALCALA is an NGO, established in Costa Rica in 2005 which launched the first Latin American Association on LCA. More information: http://rediberoamericanadeciclodevida.wordpress.com/
innovative projects based on the “cradle to cradle” or “life cycle approach.” The first three editions of the prize were given in 2006, 2008 and 2010. In 2010, thirteen projects received a 1-year license of life cycle software. The next award will be given in 2012.

Looking Ahead To Phase 3

Maintaining a strong global network of practitioners and stakeholders requires, among others, a constant exchange of new information, consistent outreach to new members and new energy, and engagement of network participants in on-going capacity building. The Life Cycle Initiative will be putting significant effort into these activities, focused on key priorities identified in the Phase 3 strategy development sessions in early 2012.

The delivery of consistent and robust results by life cycle practitioners globally is necessary to build confidence of the use of life cycle approaches with a growing life cycle assessment clientele. Within the Phase 3 Activities of the Life Cycle Initiative, a Code of Conduct will be developed in cooperation with relevant stakeholders of the global network, and promoted as a means to encourage a consistent external approach with clients as well as a consistent internal approach to methodologies.

Life Cycle ‘Champions’

Local and national networks of life cycle practitioners and stakeholders

The Life Cycle Initiative has been working over the past decade to broaden the base of practitioners and stakeholders working with life cycle approaches around the world, and to establish links between those working in the same countries and regions. The map below indicates the networks with which the Life Cycle Initiative has regular contact for discussions, feedback, and assistance in the preparation and roll-out of materials.
5.7 Communicating Life Cycle Information – The right story for every audience

Life cycle assessment consists of the identification and assessment of impacts along a product’s value chain and then, communication of the result in a useful way so that the information can be used for decision making. The main goal of communicating life cycle information in the transition to a green economy then, is to induce change toward more sustainable decision making from all stakeholders on processes, products and organizations.

The main providers of life cycle information, also called Environmental Product Information (EPI), are industry and businesses, i.e. the supply side. The latter are motivated by a series of driving forces, which depend on the target audience and which include the communication of EPI to (list not exhaustive):  

- Final private consumers, in order to get competitive advantage in emerging or new green markets.
- Business clients, either because requested to (this is especially the case of SMEs in the supply chain), or to compete in the business-to-business market arena.
- Societal and other stakeholders, to respond to the external pressure from environmental NGOs and consumer associations, and to convey a more holistic life cycle picture of products and services, in order to induce an appropriate use and disposal of products.
- Financial stakeholders, who are increasingly attentive to the sustainable dimensions of organizations and products.
- Public administrations, in order to apply to Green Public Procurement (GPP) programmes and/or to obtain tax incentives, whenever applicable.
- Policy makers, providing credible life cycle information and reference data to support them in better-informed policy decisions and to prevent a misuse of life cycle approach and simplistic green claims, which might be highly misleading.

Life cycle information can be communicated in many ways, with varying levels of detail, considering various parts of the life cycle, different pillars of sustainable development (i.e., environmental / economic / social), and with varying levels of external verification. Some address a broad range of indicators, and some focus on one or two indicators. Some are based on full life cycle assessments and some on life cycle thinking.

To bring some structure into this wide range of communication possibilities, ISO has put in place the ISO 14020 series of environmental standards, which describes three main types of labels, appropriately named Type I, Type II and Type III. The ISO Type labels are closely aligned to the main audiences receiving the information, that is, business (Type III) and consumers (Type I and Type II), but there is

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Communicating to the consumers of the future

Bringing the life cycle message to the next generation of world business and political leaders is the next logical step towards changing behaviors and attitudes toward sustainability. To this end, a colourful booklet has been published by the Brazilian Institute of Information Science and Technology to teach school-age children about life cycle thinking through elaboration of 6 R’s: Rethink, Restore, Repair, Reduce, Reuse and Recycle. Learners are engaged through dialogues, colouring exercises as well as creative text and illustrations.

some overlap. These, and some of the additional means of communicating life cycle information to various audiences are described below.

Business to Business

Decisions in business mean the difference between profit and loss, and can thus make or break an enterprise. Good decisions depend on detailed, accurate, reliable information such as that provided through the ISO Type III Environmental Product Declaration (EPD), which is based on a Life Cycle Assessment (LCA) study carried out in accordance with the ISO 14040 series.

EPDs add the benefit of comparability with other similar products, while improving company credibility through the use of an objective science-based LCA. EPDs are being used, among others, in the automotive, chemicals, construction, energy & transport, electrical and electronic equipment, food, packaging, pulp & paper, textiles and tourism sectors.\(^{18}\)

Business to Consumer

How much information do consumers need to make an informed, more sustainable purchase decision? The range of information that could be made available can quickly overwhelm the most informed and engaged consumer. In some cases, information is important to provide after the purchase has been made. A few different strategies are used to cater to this key audience.

Product labels

The ISO Type I label, otherwise known as an eco-label (e.g., German ‘Blue Angel’, Japanese ‘Eco-Mark’, etc.) is based on life cycle thinking, (i.e. key impacts of product

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\(^{18}\) Ibid.

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Life Cycle ‘Champion’

Prof. Dr. Walter Kloepffer, long-time Life Cycle Practitioner, Writer, and Editor-in-Chief of the International Journal of Life Cycle Assessment

A successful publication comes out when the right author or editor prepares the right work at the right time and at the right place/publisher. This multi-part event happened when Walter Kloepffer entered the LCA stage. In 1995, he was appointed to the Editor-in-Chief of *The International Journal of Life Cycle Assessment* (Int J LCA), the first journal entirely devoted to LCA.

The journal prospered rapidly, because the LCA community grew fast and expanded from consultancy and industry toward university during the 1990s. For PhD students and young professors it was important to have a recognized journal accepting LCA articles. Int J LCA is a beacon, drawing together research and results from the thinkers and practitioners in the field, providing a vehicle for sharing knowledge gained from around the world on the full range of life cycle assessment approaches and tools. New concepts, results from life cycle assessments, and further developments on life cycle tools are revealed and vetted here. For example, the upcoming issue continues the tradition of pushing forward the development of life cycle approaches with a special focus on life cycle sustainability assessment. In 2012, Int J LCA is in its 17th year of publication.

After studying chemistry at the University of Graz, Austria, Prof. Kloepffer worked for nearly three decades at the Battelle Institute in Frankfurt and then in the CAU GmbH where he was the scientific leader of CAU’s working group on “Life Cycle Assessment and Assessment of Chemicals” from 1992-2003. Under his leadership, the group made numerous contributions to the development of LCA-methodology, especially regarding Life Cycle Impact Assessment (LCIA).

Professor Klöpffer has, himself, published numerous articles and co-authored several books on various life cycle assessment themes. Since 2003, Life Cycle based Sustainability Assessment (LCSA) has become a major concern, and this is why he is one of the authors of the LCC guideline (see message 3). Prof. Kloepffer is currently developing an Encyclopedia of Life Cycle Assessment, which will consist of 9 volumes dealing with all aspects of Life Cycle Assessment and related methods.

He also served on board of the council of SETAC-Europe and as a member of the LCA Steering Committee. Walter is the second recipient of the biannual SETAC Europe “Award for Life-time Achievement in Life Cycle” (2008).

His work as a freelance consultant for life cycle assessment and evaluation of chemicals in Frankfurt keeps Prof. Kloepffer active as a practitioner, and he continues to shape the overall field of life cycle assessment research and development as Editor-in-Chief of the International Journal of Life Cycle Assessment.

More information: [http://www.kloepffer.de](http://www.kloepffer.de)
category around their life cycle), and are certified by third-party organizations. These indicate the overall environmental preferability of a product within a particular product category – as such often referred to as ‘leadership labels’ – and provide consumers with concise information that enables them to make quick purchasing decisions. ISO Type I labels are the most widely used EPI tools used by industry and business in many industrialized countries and increasingly in developing and emerging economies for their communication to consumers.¹⁹

ISO Type II labels mimic eco-labels, except that they are self-generated by the enterprise itself based on indicators chosen by the enterprise, and are posted on products without any third party verification. The relationship with the product life cycle is implicit, and generally weak. ISO Type II labels are, however, subject to national consumer protection laws, and so cannot be used to mislead consumers by exaggerating positive claims.

¹⁹ Ibid.

**Life Cycle Phase-specific Communications**

Some communication directed to consumers focuses on the use and disposal phases as these are the parts of the life cycle that consumers can influence most. For example, in home appliance stores, energy consumption labels are posted for easy comparison between different producers’ models. In some cases it is not important to indicate quantitative information (e.g., energy consumption) but to motivate actions that will enable a reduction of a product’s impact. For shampoo, it is important that consumers think about turning off the shower when washing their hair or reducing the shower water temperature – this has been achieved through in-store posters or flyers. For mobile phones, the key is to inform consumers about recycling their phones at the end of their useful life, usually achieved through a brochure included in the phone’s packaging.

**Communicating to motivate sustainable consumption**

Governments also have a role to play in communicating life cycle information, because they have the responsibility of improving the overall state of society and, as a trusted source of information, can motivate change in their citizens. Through life cycle studies, it has become clear that certain behaviours are more sustainable than others and can be encouraged through public service communications. For example, messages on the relative climate change benefits

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**UNEP Eco-labeling Project: Enabling developing countries to seize eco-label opportunities**

The project implemented by the UNEP Sustainable Consumption and Production Branch focused on capacity building and technical assistance for industries to meet the requirements of the life cycle based eco-labels (ISO Type I) used in export markets and for governments to create enabling policy framework in synergies with other policy approaches such as public procurement. The project addressed obstacles and challenges that businesses in developing countries may face in order to benefit from eco-labeling opportunities. By the end of the project eleven companies from seven countries in textiles (India and South Africa), footwear (Mexico and Kenya/Ethiopia), paper (Brazil) and televisions (China) industries applied for the certification with the EU Ecolabel selected for the project for the demonstration purpose. The governments of Mexico, China, Brazil and South Africa have also taken on board the strategic need of providing reliable and meaningful information about product performance through developing concrete programmes and initiatives. Moreover, the project sought to promote greater cooperation among eco-labelling schemes and worked actively on this with the Global Eco-labelling Network, an association of national labelling programmes from around the world.
of public transport over personal transport, or the climate change and health benefits of consuming less meat, etc.

Still other efforts to enhance consumer communications have been undertaken by third parties or NGOs. For example, one NGO has gathered life cycle information on consumer products, created a comparable metric that can be used across product types, and has provided this information directly to consumers via an easy to use web site, or mobile phone apps in combination with product bar-scanning apps. Another NGO, comprised of environmental and social label certifying organizations has formed to develop and monitor the application of a Code of Good Practice for Setting Social and Environmental Standards. By adhering to this code, standard setting organizations help to ensure that when they create or apply their standard it will result in measurable progress towards their social and environmental objectives, without creating unnecessary hurdles to international trade.

Corporate Reporting

Corporate accounts and environmental or social performance reports, which already contain details of an enterprise's social and environmental initiatives, may be retooled to be more product-oriented, thus providing a practical forum to document results and make them public. A proven framework for sustainability reporting that is widely used around the world is provided through the Global Reporting Initiative (GRI). Corporate reports are now beginning to provide information that goes beyond their company gates to describe additional parts of their products’ value chains. For example, the 2010 PUMA Combined Financial and Sustainability Report includes the financial cost of their environmental impact on the balance sheet. The company is also working with 20 of its main suppliers to enable them to publish their own sustainability reports in 2011 in a joint project with the GRI and the German Society for Technical Cooperation (GTZ).

Life Cycle ‘Avant Garde’

Capitalizing on the power of Social Networks (e.g. Linked in) and online tools

New media is a term that has garnered much attention over the past decade. Interactivity, user-generated content, virtual communities and many other web-based phenomena have changed the way people around the world interact and share information. Social web sites such as Facebook, Twitter, and LinkedIn cater to the communication requirements of different groups, allowing friends and like-minded professionals exchange ideas, concepts, and increase collective knowledge. This is also true for the life cycle community.

For example, LinkedIn has groups that deal directly with life cycle issues (e.g., Life Cycle Assessment group, Life Cycle Management group), which provide the medium for discussions over an incredible range of topics such as life cycle assessment best practices, new capability development courses, where to source hard to find information for specific issues, calls for life cycle practitioners to undertake assessments, and much more. Other LinkedIn groups inherently have life cycle perspectives at their core (e.g., Value of Water group, Sustainability Professionals group), with sustainable consumption issues such as barriers to energy efficiency, plastic and bottle and bag recycling, and what makes a successful eco-label, forming just a small part of the discussions with direct links to life cycle perspectives. The discussions within online groups such as these also act as a barometer for the upcoming issues within the life cycle field, and can indicate where efforts need to be made for overcoming key challenges.

Similarly, broadband internet has enabled the gathering of people in a virtual way that resembles participation at a group meeting or seminar. These ‘webinars’ enable interactive discussions with global participants while requiring only a high-speed internet connection, video camera, microphone and speakers. With new higher speed mobile technologies being unrolled, mobile devices can enable webinar participation even while on-the-go.

The Life Cycle Initiative will capitalize on the opportunities presented by the new social media sites as another vehicle to gain valuable feedback in a cost and time efficient way from stakeholders on its activities and deliverables. Another benefit from leveraging the collective knowledge of the global online network of motivated and committed practitioners – compared to the traditional meetings, conferences and workshops, it is effectively reducing the ecological footprint required to move the life cycle agenda forward!
**In Retrospect:**
**What We Accomplished in Phase 1 and 2**

The following deliverables were published or contributed to as part of the Life Cycle Initiative’s work programme on communicating life cycle information, including general awareness raising/educational materials, as well as publications for practitioners:

  This publication introduces a life cycle approach as one means to help us recognize opportunities, balance opportunities with risks and make choices that contribute value to our economies, our natural environments, and our communities. This publication is also available in: French, Spanish, Chinese and Japanese. [http://www.unep.fr/scp/publications/details.asp?id=DTI/0585/PA](http://www.unep.fr/scp/publications/details.asp?id=DTI/0585/PA)

- **Communication of Life Cycle Information in the Building and Energy Sectors**
  This report provides a comprehensive overview and the state-of-the-art of Environmental Product Information Systems (EPIS) in the Building and Energy sectors. Background information about the three ISO types for EPIS is given, followed by a comprehensive descriptive inventory of EPIS in the building and energy sectors worldwide. Environmental product declarations (EPD) are also described. [http://www.unep.fr/shared/publications/pdf/DTIx1090xPA-CommunicationofLCInfoinBuildingandEnergy.pdf](http://www.unep.fr/shared/publications/pdf/DTIx1090xPA-CommunicationofLCInfoinBuildingandEnergy.pdf)

- **International Journal of Life Cycle Assessment**
  The International Journal of Life Cycle Assessment is the first journal devoted entirely to Life Cycle Assessment. It is a forum for scientists developing LCA and LCM; LCA and LCM practitioners, managers concerned with environmental aspects of products, governmental environmental agencies responsible for product quality, scientific and industrial societies involved in LCA development, and ecological institutions and bodies. [http://www.springer.com/environment/journal/11367](http://www.springer.com/environment/journal/11367)

**Looking Ahead to Phase 3**

The Life Cycle Initiative’s main activities in Phase 3 seek to engage the life cycle communities, experts and people who have influence on Life Cycle Assessment topics, in a long-term dialogue; increase the public awareness on LCA and LCM issues; create an open discussion environment between experts and the general public; and help to transfer the scientific knowledge (which is mainly discussed in the academic field) to a broader society.

The Life Cycle (LC) Platform and Social Media flagship project has a new informative, interactive and educational virtual platform with a communication strategy based on social media tools at its core. The LC platform will contribute to the LC awareness by sharing relevant knowledge and data. Relevant knowledge to be shared can be extracted from relevant LC studies, key business websites presenting clear benefits (and challenges) from implementing life cycle approaches, life cycle databases registries, websites from similar related initiatives sharing online tools, etc. The LC platform will also help identifying the most relevant life cycle trends, which will support the flagship project on emerging ideas.
6. THE FUTURE OF LIFE CYCLE THINKING – RISKS, GAPS AND NEXT STEPS

The Agenda is Moving Forward, but...

The good news for the future is that companies and governments are increasingly taking on board life cycle thinking and approaches. These forerunners in the field recognize the benefits of organizing their operations through life cycle management and informing their decisions using the results of life cycle assessments. This is leading to:

- Better and more informed decisions being made that will benefit the environment and society in the long run.
- Products, services and policies that are greener; consumers that are better informed about product environmental and social impacts; stakeholders that are more aware of companies’ commitments to sustainability.
- More experience and competency in life cycle approaches and methodologies thus improving the speed and robustness of the process and results.
- The creation of green jobs – employment for experts and companies that are competent in life cycle management and assessment methodologies.

On the other hand, this increasing demand is not without potential pitfalls. The race to provide life cycle management and assessment consulting services may lead to unqualified start-ups that deliver inconsistent, substandard outcomes while seeking to earn quick profits. Decisions based on recommendations derived from unsound information will not likely lead to a green economy and can do more harm than good.

Identifying the Gaps and Challenges

In 2011, the Life Cycle Initiative began an extensive consultation process involving an outreach survey, focus group discussion and a meeting with experts with the results to be used as a starting point for its Phase 3 strategy development process. This consultation process resulted in several valuable insights into the gaps faced by practitioners and the challenges facing the overall life cycle field. The feedback derived from the participants is summarized in the following points.

- **What is limiting more implementation of LC approaches in your country or industry?**
  1. Data
  2. Lack of business drivers
  3. Lack of awareness/understanding
  4. Cost
  5. Competition with other tools Carbon footprinting (water footprinting), CSR
  6. Lack of harmonization between methods
  7. Difficult to access small/medium sized enterprises

- **As an LCA professional, what would be your aspirations for 2017?**
  1. Education: e.g., life cycle thinking in schools and LCA courses in higher education
  2. Integration into business: e.g., all companies understand LCA
  3. LC as a basis for decision making: e.g., LCA results are used as key information for decision making by government, industry, and by consumers
  4. Application in non-OECD countries: e.g., as a means to prevent shifting the impact burden to countries that don’t follow a life cycle approach
  5. LCA of products: e.g., to make life cycle derived environmental performance information of relevant products available to consumers

- **What are your expectations of the LC Initiative during the next 3-5 years?**
  1. Databases
  2. Non-OECD engagement to achieve a minimum standard of LCA usage
  3. Harmonization / consensus building on methodologies
  4. Continued methodological development
  5. Training of practitioners
  6. Communication / awareness raising / lobbying
  7. Educate key decision makers in industry and government
  8. Partnering, Case study development, Dissemination, Engaging with governments
Flagship Projects Focusing on Key Phase 3 Challenges

Building on the successes of the first two phases of activities from 2002 to 2012 and following from the expert consultation outcomes, the Life Cycle Initiative will start Phase 3 in 2012 with a **mission to enable the global use of credible life cycle knowledge for more sustainable societies**. Our **overarching goal** is to **facilitate the generation and uptake of science-based life cycle approaches and information for products and organization by government, business and civil society practice worldwide as a basis for sustainable consumption and production**.

The work programme, derived through an intensive strategy development process, is grouped under a number of flagship projects that are prioritized for implementation, including:

1. **Life cycle sustainability approaches** – Some of the tools developed during Phase II have not yet reached full maturity in order to be used on a broad scale. Efforts here will focus on further development and testing of S-LCA and LCSA in particular. The specific objectives of this flagship are four-fold:
   - Expanded capability worldwide to apply and use S-LCA and LCSA in different communities;
   - Awareness among decision-makers, stakeholders and public;
   - Enhanced global consensus on the S-LCA and LCSA-methodology (including data management);
   - Increased linkages with the emerging initiatives on LCA approaches for organizations.

2. **Environmental life cycle impact assessment indicators** – The objective here is to run a global process aiming at global guidance and consensus building on a limited number of life cycle impact category indicators developed within a consistent framework, and to identify the related research agenda. The deliverable would be a global guidance publication with a supporting web system that includes the limited number of 6 to 10 LCA-based environmental impact category indicators and the characterisation factors (for various regions). It may also include guidance on how to best establish a particular regional impact category indicator in case global consensus on characterisation factors cannot be achieved or makes no sense.

3. **Data and database management** – The expert consultations revealed that a gap faced by all practitioners is inconsistency in the development and management of databases, as well as the availability and reliability of local data. This situation is not desirable for the consistent global practice of LCA because practitioners and their clients may question that the results of a global LCA truly reflect the burdens and potential impacts of where activities in the life cycle actually occur. The focus of this flagship is therefore on:
   - Promoting a consistent approach to unit process and aggregated datasets;
   - Database development and management through the communication of the guidance principles;
   - Expansion and enhancement of the database registry; and
   - Training and technical assistance.

The aim is to create and coordinate a network of database managers and other closely allied actors in the data ecosystem. It further aims to develop, train trainers and deliver effective instruction on the Global Guidance Principles in order to facilitate consistent and conforming practices globally.

4. **Product environmental information meta ‘specification’** – Multiple efforts are ongoing in different parts of the world to develop an authoritative identification of the hotspots and most relevant environmental impacts and resource uses for a certain product categories or group. This flagship project seeks to provide guidance on the broader considerations that should be taken into account, and the key principles that could be applied for different product sustainability information systems to allow more informed decision making by purchasers.

5. **Knowledge mining guidance** – There are hundreds of existing LCA studies that, taken together, represent a significant base of knowledge that can be tapped into. The aim of this flagship is to provide a methodology for mining knowledge from these LCA studies, using a pilot study to demonstrate the value of this process (food packaging sector). Can we use the review of existing studies to identify critical messages or themes that might inform experts in the field and policy makers in government and industry?
these studies with regard to how they have translated the technical and scientific information into a language that can be understood by institutional buyers or consumers?

6. **Global capability development** – This flagship project has the aim to strengthen and consolidate the life cycle work in the regions, including documentation of local consultants and databases available. Focal points at governmental offices (including national statistic offices for data management aspects) and chambers of commerce will be identified and linked to the national networks. Some deliverables identified for this flagship include:

- Establishing a baseline on the level of life cycle thinking worldwide, assessing the current capabilities on life cycle issues in non-OECD countries, with updates planned for every 3 years to trace the evolution.
- Life cycle tools (i.e. on life cycle management, life cycle based footprinting indicators and ecodesign) spread across the emerging and rapidly growing economies via the Life Cycle Initiative’s or local platforms.
- South-south (e.g. in Latin America) cooperation for increased implementation and North-South cooperation for methodologies’ enhancement, data generation and exchange.

7. **Communicating life cycle knowledge** - The main deliverable for this flagship is a new informative, interactive and educational virtual platform with a communication strategy based on social media tools. The LC platform will contribute to life cycle awareness by sharing relevant knowledge and data. Relevant knowledge to be shared can be extracted from relevant life cycle studies, key business websites presenting clear benefits (and challenges) from implementing life cycle approaches, life cycle database registries, websites from similar and related initiatives sharing online tools, and so on. The LC platform will also help identify the most relevant life cycle trends. A further element here is enhanced stakeholder outreach through various means, including multi-stakeholder roundtables.

Many additional activities outside the flagship projects are also planned and are described on the UNEP/SETAC web page: [http://www.lifecycleinitiative.org](http://www.lifecycleinitiative.org).

7. **AN INVITATION**

**Join the Life Cycle Initiative in supporting the transition to a green economy**

At the RIO+20 Summit meetings and in the coming years, much discussion and effort will go into determining the best possible way forward to transition to a global green economy within the context of sustainable development and poverty eradication. This publication has made the argument that part of this discussion and effort should be directed toward life cycle thinking and approaches for the following key reasons:

1. Life cycle thinking and approaches can help governments make procurement and policy decisions that lead to environmental protection and the betterment of society.

2. Life cycle management and tools can help business improve the environmental performance of their products and services while taking into account social perspectives of the people working in the value chain.

3. Communication of life cycle information can help consumers choose greener and fairer products.

4. Increased demand for life cycle consulting and services creates green jobs for experts in the life cycle field.

The Life Cycle Initiative has been working to support the transition to a green economy for the past ten years by focusing on life cycle thinking and approaches. We welcome interest, support and new partners for the next phase of our activities.

For more information: [www.lifecycleinitiative.org](http://www.lifecycleinitiative.org)
8. Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon footprint</td>
<td>A total product carbon footprint is a measure of the direct and indirect greenhouse gas (GHG) emissions associated with all activities in the product's life cycle. Products are both goods and services. Such a carbon footprint can be calculated by performing (according to international standards) an LCA that concentrates on GHG emissions that have an effect on climate change (UNEP/SETAC, 2009)</td>
</tr>
<tr>
<td>Cradle-to-grave</td>
<td>A cradle-to-grave assessment considers impacts at each stage of a product's life cycle, from the time natural resources are extracted from the ground and processed through each subsequent stage of manufacturing, transportation, product use, recycling, and ultimately, disposal. (Athena Institute &amp; National Renewable Energy Laboratory draft, 2010)</td>
</tr>
<tr>
<td>Data management</td>
<td>Administrative process by which the required data is acquired, validated, stored, protected, and processed, and by which its accessibility, reliability, and timeliness is ensured to satisfy the needs of the data users. (Business Dictionary no date)</td>
</tr>
<tr>
<td>Data mining</td>
<td>Generally, data mining […] is the process of analyzing data from different perspectives and summarizing it into useful information […]. Technically, data mining is the process of finding correlations or patterns among dozens of fields in large relational databases. (Palace, 1996)</td>
</tr>
<tr>
<td>Data quality</td>
<td>Characteristics of data that relate to their ability to satisfy stated requirements. (ISO 2006)</td>
</tr>
<tr>
<td>Data source</td>
<td>Origin of data. (ISO 2002)</td>
</tr>
<tr>
<td>Database developer</td>
<td>Database developers are the ones who build or develop databases and may not be only owners or the providers. (UNEP/SETAC, 2011)</td>
</tr>
<tr>
<td>Dataset (LCI or LCIA dataset)</td>
<td>A document or file with life cycle information of a specified product or other reference (e.g., site, process), covering descriptive metadata and quantitative life cycle inventory and/or life cycle impact assessment data, respectively. (European Commission - Joint Research Centre - Institute for Environment and Sustainability, 2009)</td>
</tr>
<tr>
<td>E-LCA</td>
<td>Environmental Life Cycle Assessment (E-LCA), is an assessment technique that aims at addressing the environmental aspects and their potential environmental impacts throughout a product’s life cycle.</td>
</tr>
<tr>
<td>Environmental aspect</td>
<td>Element of an organization’s activities, products or services that can interact with the environment. (ISO 2004)</td>
</tr>
<tr>
<td>Environmental product declaration (EPD)</td>
<td>An EPD is a standardized (ISO 14025/TR) and LCA based tool to communicate the environmental performance of a product or system, and is applicable worldwide for all interested companies and organizations. (<a href="http://www.environmentalproductdeclarations.com/">http://www.environmentalproductdeclarations.com/</a>)</td>
</tr>
<tr>
<td>Impact category</td>
<td>Impact Categories are logical groupings of Life Cycle Assessment results of interest to stakeholders and decision makers. (UNEP/SETAC, 2009)</td>
</tr>
<tr>
<td>Life cycle</td>
<td>Consecutive and interlinked stages of a product system, from raw material acquisition or generation from natural resources to final disposal. (ISO 2006)</td>
</tr>
<tr>
<td>Life cycle approaches</td>
<td>Techniques and tools to inventory and assess the impacts along the life cycle of products.</td>
</tr>
<tr>
<td>Life cycle assessment (LCA)</td>
<td>Compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle. (ISO 2006)</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>--------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Life cycle costing (LCC)</td>
<td>Life cycle costing, or LCC, is a compilation and assessment of all costs related to a product, over its entire life cycle, from production to use, maintenance and disposal. (UNEP/SETAC, 2009)</td>
</tr>
<tr>
<td>Life cycle database registry</td>
<td>A global database in which quality life cycle databases can be registered. (UNEP/SETAC, 2011)</td>
</tr>
<tr>
<td>Life cycle dataset library</td>
<td>A global database of registered and searchable life cycle datasets. (UNEP/SETAC, 2011)</td>
</tr>
<tr>
<td>Life cycle impact assessment (LCIA)</td>
<td>The phase of Life Cycle Assessment aimed at understanding and evaluating the magnitude and significance of the potential environmental impacts for a product system throughout the life cycle of the product. (ISO 2006)</td>
</tr>
<tr>
<td>Life cycle interpretation</td>
<td>The phase of Life Cycle Assessment in which the findings of either the inventory analysis or the impact assessment, or both, are evaluated in relation to the defined goal and scope in order to reach conclusions and recommendations. (ISO 2006)</td>
</tr>
<tr>
<td>Life cycle inventory (LCI)</td>
<td>The phase of Life Cycle Assessment where data are collected, the systems are modeled, and the LCI results are obtained. (UNEP/SETAC, 2009)</td>
</tr>
<tr>
<td>Life cycle inventory analysis</td>
<td>The phase of Life Cycle Assessment involving the compilation and quantification of inputs and outputs for a product throughout its life cycle. (ISO 2006)</td>
</tr>
<tr>
<td>Life cycle inventory database</td>
<td>A system intended to organize, store, and retrieve large amounts of digital LCI datasets easily. It consists of an organized collection of LCI datasets that completely or partially conforms to a common set of criteria, including methodology, format, review, and nomenclature, and that allows for interconnection of individual datasets that can be specified for use with identified impact assessment methods in application of life cycle assessments and life cycle impact assessments. (UNEP/SETAC, 2011)</td>
</tr>
<tr>
<td>Life cycle management (LCM)</td>
<td>A product management system aimed at minimizing the environmental and socio-economic burdens associated with an organization’s product or product portfolio during its entire life cycle and value chain. LCM supports the business assimilation of product policies adopted by governments. This is done by making life cycle approaches operational and through the continuous improvement of product systems. (UNEP/SETAC, 2007)</td>
</tr>
<tr>
<td>Life cycle management systems</td>
<td>Management systems that incorporate the basic life cycle principles plus key elements of ISO 9000, ISO 14000, and ISO 26000 to ensure continuous improvement: The plan-do-check-act cycle; Policy, objectives and targets; Procedures and instructions; Monitoring and registration systems; and Documentation and reporting.</td>
</tr>
<tr>
<td>Life cycle programmes and activities</td>
<td>Initiatives that support decision making based on life cycle thinking at one or more organizational units (e.g. at the design, procurement, recycling units).</td>
</tr>
<tr>
<td>Life cycle public policies</td>
<td>Public policies that incorporate or are based on life cycle guiding principles.</td>
</tr>
<tr>
<td>Life cycle sustainability assessment (LCSA)</td>
<td>Life cycle sustainability assessment (LCSA) refers to the evaluation of all environmental, social and economic negative impacts and benefits in decision making processes towards more sustainable products throughout their life cycle. (UNEP/SETAC, 2011)</td>
</tr>
<tr>
<td>Life cycle thinking</td>
<td>Life Cycle Thinking is a mostly qualitative discussion to identify stages of the life cycle and/or the potential environmental impacts of greatest significance e.g. for use in a design brief or in an introductory discussion of policy measures. The greatest benefit is that it helps focus consideration of the full life cycle of the product or system; data are typically qualitative (statements) or very general and available-by-heart quantitative data. (Christiansen et al., 1997)</td>
</tr>
<tr>
<td>Metadata (descriptor)</td>
<td>Data that defines and describes other data and processes. (ISO 2004)</td>
</tr>
<tr>
<td>----------------------</td>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>Process</td>
<td>Set of interrelated or interacting activities that transforms inputs into outputs. (ISO 2005)</td>
</tr>
<tr>
<td>Product</td>
<td>Any goods or service. (ISO 2006)</td>
</tr>
<tr>
<td>Product flow</td>
<td>Products entering from or leaving to another product system. (ISO 2006)</td>
</tr>
<tr>
<td>Product system</td>
<td>Collection of unit processes with elementary and product flows, performing one or more defined functions, and which models the life cycle of a product. (ISO 2006)</td>
</tr>
<tr>
<td>Raw material</td>
<td>Primary or secondary material that is used to produce a product. (ISO 2006)</td>
</tr>
<tr>
<td>Recycling</td>
<td>The use of a by-product output of one product system as input to another product system. (UNEP/SETAC, 2011)</td>
</tr>
<tr>
<td>Social life cycle assessment (S-LCA)</td>
<td>A social and socio-economic life cycle assessment (S-LCA) is a social impact (real and potential impacts) assessment technique that aims to assess the social and socio-economic aspects of products and their positive and negative impacts along their life cycle encompassing extraction and processing of raw materials; manufacturing; distribution; use; reuse; maintenance; recycling; and final disposal. (UNEP/SETAC, 2009)</td>
</tr>
<tr>
<td>Social computing</td>
<td>A pervasive trend towards the construction of web-based applications that link together users in extended social networks and harness the data that are generated by their use of the application. For instance, social recommendation tools found on many e-commerce sites (&quot;customers who bought this book also enjoyed…&quot;) are a form of social computing, as is the &quot;tagging&quot; (addition of textual metadata to photos) by users of popular social sites such as Flickr or Facebook. (UNEP/SETAC, 2011)</td>
</tr>
<tr>
<td>Sustainable consumption and production</td>
<td>The use of services and related products, which respond to basic needs and bring a better quality of life while minimizing the use of natural resources and toxic materials as well as the emissions of waste and pollutants over the life cycle of the service or products so as not to jeopardize the needs of future generations. (UNCSD, 1995)</td>
</tr>
<tr>
<td>Uncertainty</td>
<td>Quantitative definition: Measurement that characterizes the dispersion of values that could reasonably be attributed to a parameter. (adapted from ISO 1995) Qualitative definition: A general and imprecise term which refers to the lack of certainty in data and methodology choices, such as the application of non-representative factors or methods, incomplete data on sources and sinks, lack of transparency, etc. (WRI and WBCSD, 2010)</td>
</tr>
<tr>
<td>Waste</td>
<td>Substances or objects which the holder intends or is required to dispose of. (ISO 2006)</td>
</tr>
<tr>
<td>Working environmental life cycle assessment (WE-LCA)</td>
<td>Working environmental LCA is a compilation and evaluation of the inputs, outputs and potential working environmental impacts on humans of a product system throughout its life cycle. (Poulsen and Jensen, 2004)</td>
</tr>
<tr>
<td>Web 2.0</td>
<td>A collection of information technologies (primarily web-based) and a set of operating principles that build upon these technologies to change the way in which users interact with web-based applications. The term was coined in the early 2000s by Tim O’Reilly, and has come to mean web-based applications that involve their users in an active role, often by allowing them to easily add information in the form of comments, ratings, or other evaluations of data found online. (UNEP/SETAC, 2011)</td>
</tr>
</tbody>
</table>
## ANNEX I – LINKS TO REGION/COUNTRY DIRECTIVES

Links to information on the life cycle based directives/regulations indicated on the map in Section 5.2

<table>
<thead>
<tr>
<th>Country / Region</th>
<th>Web site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>L’analyse des coûts du cycle de vie (ACCV) dans les marchés publics (durables)</td>
</tr>
<tr>
<td>France</td>
<td>Affichage Environnemental</td>
</tr>
<tr>
<td>Mexico</td>
<td>La Estrategia Nacional de Producción y Consumo Sustentable</td>
</tr>
</tbody>
</table>

**Some additional examples**

## ANNEX 2 – ACRONYMS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPD</td>
<td>Environmental Product Declaration</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>ISO</td>
<td>International Organization for Standardization</td>
</tr>
<tr>
<td>E-LCA</td>
<td>Environmental life cycle assessment</td>
</tr>
<tr>
<td>LCA</td>
<td>Life cycle assessment</td>
</tr>
<tr>
<td>LCC</td>
<td>Life cycle costing</td>
</tr>
<tr>
<td>LCI</td>
<td>Life cycle inventory analysis</td>
</tr>
<tr>
<td>LCIA</td>
<td>Life cycle impact assessment</td>
</tr>
<tr>
<td>LCM</td>
<td>Life cycle management</td>
</tr>
<tr>
<td>LCSA</td>
<td>Life cycle sustainability assessment</td>
</tr>
<tr>
<td>LCT</td>
<td>Life cycle thinking</td>
</tr>
<tr>
<td>NGO</td>
<td>Non governmental organization</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Research and development</td>
</tr>
<tr>
<td>SCP</td>
<td>Sustainable consumption and production</td>
</tr>
<tr>
<td>SETAC</td>
<td>Society for Environmental Toxicology and Chemistry</td>
</tr>
<tr>
<td>S-LCA</td>
<td>Social life cycle assessment</td>
</tr>
<tr>
<td>UN</td>
<td>United Nations</td>
</tr>
<tr>
<td>UNCED</td>
<td>United Nations Conference on Environment and Development</td>
</tr>
<tr>
<td>UNEP</td>
<td>United Nations Environment Programme</td>
</tr>
<tr>
<td>UNEP-DTIE</td>
<td>United Nations Environment Programme – Division of Technology, Industry and Economics</td>
</tr>
<tr>
<td>WBCSD</td>
<td>World Business Council for Sustainable Development</td>
</tr>
<tr>
<td>WSSD</td>
<td>World Summit on Sustainable Development</td>
</tr>
</tbody>
</table>
SPONSORS AND STRATEGIC PARTNERS
OF THE UNEP/SETAC LIFE CYCLE INITIATIVE

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Academic Private Partnerships as Platinum Sponsors

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Regional Networks and Partners

African Life Cycle Assessment Network (ALCANET), Indian LCA Society, Red Iberoamericana de Ciclo de Vida, IBICT Brazil, Sichuan University.
About SETAC

The Society of Environmental Toxicology and Chemistry (SETAC) is a professional society in the form of a non-for-profit association, established to promote the use of a multidisciplinary approach to solving problems of the impact of chemicals and technology on the environment. Environmental problems often require a combination of expertise from chemistry, toxicology, and a range of other disciplines to develop effective solutions. SETAC provides a neutral meeting ground for scientists working in universities, governments, and industry who meet, as private persons not bound to defend positions, but simply to use the best science available.

Among other things, SETAC has taken a leading role in the development of Life Cycle Management (LCM) and Life Cycle Assessment (LCA).

The organization is often quoted as a reference on LCA matters.

For more information, see www.setac.org
About the UNEP Division of Technology, Industry and Economics

Set up in 1975, three years after UNEP was created, the Division of Technology, Economics (DTIE) provides solutions to policy-makers and helps change the business environment by offering platforms for dialogue and co-operation, innovative policy options, pilot projects and creative market mechanisms.

DTIE plays a leading role in three of the six UNEP strategic priorities: climate change, harmful substances and hazardous waste, resource efficiency.

DTIE is also actively contributing to the Green Economy Initiative launched by UNEP in 2008. This aims to shift national and world economies on to a new path, in which jobs and output growth are driven by increased investment in green sectors, and by a switch of consumers’ preferences towards environmentally friendly goods and services.

Moreover, DTIE is responsible for fulfilling UNEP’s mandate as an implementing agency for the Montreal Protocol Multilateral Fund and plays an executing role for a number of UNEP projects financed by the Global Environment Facility.

The Office of the Director, located in Paris, coordinates activities through:

- The International Environmental Technology Centre - IETC (Osaka), which implements integrated waste, water and disaster management programmes, focusing in particular on Asia.
- Sustainable Consumption and Production (Paris), which promotes sustainable consumption and production patterns as a contribution to human development through global markets.
- Chemicals (Geneva), which catalyzes global actions to bring about the sound management of chemicals and the improvement of chemical safety worldwide.
- Energy (Paris and Nairobi), which fosters energy and transport policies for sustainable development and encourages investment in renewable energy and energy efficiency.
- OzonAction (Paris), which supports the phase-out of ozone depleting substances in developing countries and countries with economies in transition to ensure implementation of the Montreal Protocol.
- Economics and Trade (Geneva), which helps countries to integrate environmental considerations into economic and trade policies, and works with the finance sector to incorporate sustainable development policies. This branch is also charged with producing green economy reports.

UNEP DTIE activities focus on raising awareness, improving the transfer of knowledge and information, fostering technological cooperation and partnerships, and implementing international conventions and agreements.

For more information, see www.unep.org/dtie
In 2012, the UNEP/SETAC Life Cycle Initiative marks its 10th year of activities. Over the past decade, it has become known as the ‘one-stop-shop’ for science-based research and development on life cycle-related tools, capability development for practitioners, and guidance on life cycle-based methodologies and approaches addressing the three pillars of sustainability (environmental, economic and social).

This publication, launched on the occasion of the World Summit on Sustainable Development in 2012, demonstrates that life cycle approaches are an important cornerstone for building the green economy. Seven messages outline the current level of the global application of life cycle thinking and show how the Life Cycle Initiative has, though several ground-breaking deliverables, contributed to moving the agenda forward. In addition, it provides a glimpse into the tools and techniques on the horizon that will shape the future practice of life cycle approaches, and how the Life Cycle Initiative's Phase 3 activities (2012-2017) will continue to underpin the development and implementation of life cycle approaches world wide.