Focusing on packaging: the Unilever Sustainable Living Plan

Next generation automation systems for food production

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Unilever has built a solid reputation as a market leader in sustainability, driven by the widely respected Unilever Sustainable Living Plan which sets out time-bound commitments which will enable us to halve our environmental impact while improving the lives of millions of people and doubling the size of our business by 2020. We firmly believe that if we focus our company strategy on improving the lives of millions of people around the globe and come up with genuine sustainable solutions, we are more in sync with our consumers’ needs and societies’ wants, which ultimately results in sustainable growth and good value return for all our investors. The Sustainable Living Plan covers a wide range of aspects, from sustainable sourcing, health and nutrition, and improved livelihoods, to manufacturing, transportation, packaging…
BRAND BUILDERS KNOW GLASS TELLS THE TRUTH. Nic Lecloux and two friends launched true fruits in 2006. “When your philosophy is true fruits, no tricks, the packaging has to have integrity,” he says. “Glass does. It’s clear, it’s natural, and it shows off our smoothies. Glass feels honest. That fits our brand.” GlassIsLife.com
consumer use and of course environmental metrics such as water usage, greenhouse gas (GHG) emissions and waste, many of which are related in some way to packaging.

Within Unilever, we consider sustainable packaging from two perspectives, both in the resources used to make the packaging and in its disposal after use. As part of the Unilever Sustainable Living Plan, we aim to halve the waste associated with our products by 2020 and to achieve this target, our highest priority actions are to reduce, reuse and recycle our packaging waste. In order to ensure we design packaging at its optimum, Unilever has three main criteria which we use in the design of our packaging:

- First, we consider packaging across the entire value-chain. This is really important as it takes into account the source of the packaging, how it is manufactured and its impact on the distribution network, shelf impact, the consumer’s interaction with it and how it is disposed of, or rather, what is its next life

- Second, we consider packaging holistically meaning that we carefully consider the product or formulation and its relation to the packaging. Well designed packaging will protect the product, it will provide good functionality thus enhancing the consumer’s experience and it will enhance the products shelf-life. Well designed packaging preserves far more resources than it uses!

- Third, we embrace the waste hierarchy thinking – Remove, Reduce, Reuse, Recycle & Recover, in that order of priority. By doing this we are clearing thinking about our direct ability to influence (through remove, reduce and reuse) and the amount of packaging waste generated, as well as thinking about how we can contribute to reducing packaging waste to landfill indirectly by considering the available recycling and recovery infrastructure in any given country

The targets we have set in the Unilever Sustainable Living Plan require us to take several different actions toward reducing our packaging and waste impact. Some of these actions are within our control, others however will require industry-wide collaboration if we are to succeed in achieving what has been described by many as extremely bold and ambitious targets.

In 2008, Unilever embarked on a project to map out its baseline footprint on three specific environmental metrics, namely; GHG, water and waste. This measurement was conducted across our top 14 countries and represents 70 per cent of our total volume. For packaging, Unilever has developed a metric which measures both the grams of packaging material and the product left over in the pack. We use published national indices for recycling and recovery, or our own estimates where these are not available, and measure on a ‘per consumer use’ basis, e.g. the waste associated with one serving of soup. A particular point of note is that we have not included our factory waste into these calculations, as they are captured under our eco-efficiency program, which has been running for many years.

Once we had established our waste foot, we utilised various forecasting models to determine what our footprint might look like by 2020. By understanding our starting point, which geographies we will grow in and what the related packaging material and formats might be, it has allowed us to determine what our strategy should be and where we need to focus our efforts thereby ensuring that we can match the targets which we have set ourselves. We have devised several targets under the waste metric, some of which have specific key performance indicators attached to them.

The first of these is to reduce the quantity of packaging we require for our products by one third, through adopting leading-edge design techniques and technologies thereby ensuring that the optimal amount of material is used to deliver the required functionality and specification. Material reduction plays a very important part in our strategy as it not only reduces the resource demands we place on the environment, but in most instances it also offers cost benefits to the business. We, as have all brand owners, have been looking at value innovation programs for many years, so this is not a new concept, however with current technologies, a tipping point is quickly reached where any further reductions will start to affect the quality of the product, be it in the ability to preserve and protect the product, or in the functionality of the product. Recognising this, Unilever created a Materials Capability Team of material experts specifically tasked with working with our suppliers, tertiary institutions and other value-chain partners to develop innovations which will allow us to continue with our program of continual reduction without affecting the quality of the product.

An example of this program is the conversion from aluminium foil to metallised OPP for our Unox Cup-a-Soup range in the Netherlands. The Cup-a-Soup portfolio accounts for around 8,000,000m² of pouch foil per year. By
changing to the MetOPP, we have achieved a total pouch weight reduction of six per cent and a reduction in aluminium usage in the pouch by almost 33 per cent, which in effect is a reduction of circa 52 tonnes of aluminium. This program is extending across the Savoury category portfolio.

Our second target under the waste metric, and in-line with waste hierarchy thinking, is to look for more ways to enable our consumers to reuse product packaging, for example through the development of refill packs. We have already had several successes in this area with our home and personal care categories; however, with food (due to the obvious hygiene related issues), we are finding it a little more challenging to introduce these types of packs. Another challenge which we face, is outside of geographies where reusable packaging is very well known and accepted, consumer perceptions can create barriers to entry.

One of our biggest challenges, but also opportunities, is detailed in the third target which comprises three specific focus areas. Unilever recognises that no matter how much work is done to reduce or reuse packaging, there will always be something left-over, but we want our waste products to become someone else’s raw materials, and are therefore working in partnership with industry, governments and NGOs, with the aim to increase recycling and recovery rates on average by 15 per cent by 2020 in our top 14 countries. Some of our countries such as Germany and The Netherlands already have extremely high recycling and recovery rates, so our main focus is in geographies outside of Europe, although that is not always true when it comes to strategic packaging formats such as deodorant aerosols cans.

In 2008, Unilever commissioned PWC to review European aerosol recycling and to map out the basic aluminium value chain. This initial review of key aerosol markets showed that the UK is one of Unilever’s biggest aerosol markets; however, there were two specific hurdles to overcome. Awareness of aerosol recycling was very low with only 39 per cent of householders aware that aerosols can be recycled, and many local authorities and waste handling agencies were not aware aerosols could be recycled, or were resistant to handling aerosols. Unilever’s deodorants category along with the Aerosols Association (BAMA) and Alupro developed a plan enabling increased consumer awareness through three strategic thrusts; i) engaged with the local authorities to develop a communication campaign targeting householders, ii) the Brand team drove a consumer communication program along with Tesco as part of consumer education, and iii) developed and implemented on pack messaging and logos related to recycling. To date this has resulted in an increase of kerbside recycling from 67 per cent to 82 per cent and 331 local authorities are now collecting aerosols. There are many other examples of collaborations, interventions and incentivisation programs which have, or are starting to show positive results in some of our top 14 countries.

Another of our targets related to recycling is the ambition to increase the use of recycled content which we use in our packaging to maximum possible levels, particularly focused on plastics, as we believe that this will act as a catalyst to increase recycling rates. In 2011, we used over 1,700 tonnes of recycled material in our plastic bottles. Unilever has also committed, formulation permitting, to make it easier for consumers to recycle our packaging by using materials that best fit the end-of-life treatment facilities available in their countries. An example of this comes from North America, where we have converted our Hellmann’s tottle bottles from a multi-layer material to 100 per cent PET, which has now made almost 1,300 tonnes of material available for recycling.

In developing and emerging markets, we use sachets to pack single dose servings of our products so they are affordable to people on very low incomes. They are cheap, convenient and critical to our efforts to serve people at the bottom of the pyramid. We sell about 40 billion of them every year, but sachets are more difficult to recycle than many materials! The problem is that there is no economic incentive for people to collect the sachets after use because recyclers do not have a market for them and what’s more, many are made of multiple layers of material, and often contaminated with product, so they end up in landfill or as litter. We set ourselves the target of tackling sachet waste and have applied our technical know-how to help a pyrolysis plant owner in India develop a safer and more reliable way to process sachet waste at volume. But as is so often the case, technology doesn’t offer a complete solution. We now need to find a way for these billions of sachets to be collected, taken to central processing units and then sold for fuel. This is not something we can do on our own; to make progress we will need to work with governments, NGOs, customers and competitors who also use sachets. But if we all work together, we are convinced we can create a profitable industry that can operate at scale and resolve this issue in a way which creates jobs and incomes as well as reducing litter and waste to landfill.

Finally, we have set ourselves a target of sourcing 100 per cent of our paper and board from certified sustainably managed forests or from recycled material by 2020. We are making impressive strides in this area with an estimated 60 per cent of our paper and board already coming from sustainably managed forests or recycled content as of the end of 2011. Further to this, we continue to engage and explore opportunities for the introduction and use of sustainable renewable polymers.

While the targets are ambitious, we also recognise that these targets are a first step towards more sustainable packaging. We will continue to explore emerging technologies and ‘cradle-to-cradle’ approaches which require products to be designed so that resources are used in a cyclical way, meaning that materials can constantly flow round a ‘closed loop’ system, rather than being used once and then discarded. This remains an area for further development for us and the wider industry.

The Unilever Sustainable Living Plan is our business model and we use this as a basis to continually review our packaging strategy, technology roadmap, policies and position statements with regard to the environment. Through our footprint work and measurements, we have found that packaging’s biggest environmental impact is waste. While we recognise that greenhouse gas emissions are very important, by focusing on waste reduction we believe that there will be indirect GHG benefits as well. Our growth is already accelerating; we are now a EUR 46 billion company and our ambitious sustainability plan is helping to unlock new growth opportunities as well as driving our corporate reputation!
To function properly in these operations, an automation system has to locate an object and then perform a task on or with that object. If the device were a human, this would mean using the eyes and hands. “No automated machine can do as fine a work as the human hand can,” says Lee Miller who has been a boot maker for 35 years. Miller makes each boot individually for each foot. This is true not

One of my colleagues was recently asked to give a talk with the title: “Labour or Automation in Food Processing.” I ventured to suggest that the title should be: “Can We Afford Not to Have Automation Support Labour?” For many food processing operations, people are the only mechanism to provide the flexibility needed to handle the inherent variability in both products and tasks. As put by another colleague: “A big part of the problem with autonomous robots is that we can get there but once we are there we can’t easily do what we need to do.” This is particularly true in second and further processing operations where we need devices capable of performing like a human.

To function properly in these operations, an automation system has to locate an object and then perform a task on or with that object. If the device were a human, this would mean using the eyes and hands. “No automated machine can do as fine a work as the human hand can,” says Lee Miller who has been a boot maker for 35 years. Miller makes each boot individually for each foot. This is true not
just for boots but also applies to many food processing operations, especially in slaughter and post processing. Each animal is different and proper (most efficient) processing requires flexibility and adaptability of equipment. These are also difficult jobs for people, and we need to think of how we support them or vice-versa, how they support the next generation of machines.

The major issues here are our ability to sense parameters of interest and then to execute the manipulation action required. Sensing implies not only acquiring the sensor data but also the requirements for processing and extracting useful information. There have been some advances in the incorporation of robots in food processing operations, but in fruits and vegetables, for example, there have not been clear advances in grippers adapted for this purpose. The same can be said for slaughter and further processing of meat products where the variability, the surface characteristics and food safety concerns increase the challenges. Systems also have to be designed to have a human in the loop to assist in the training of the device as well as to assist in the handling of novel developments during operation. What all this implies is that one significant impediment is the lack of availability of integrated smart end effectors or manipulators. As stated by Monkmann et al., "Experience indicates that in the future it will only be possible to respond to practical demands if flexible designs for assembly equipment are available. Consequently, grippers must become ever more flexible".

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insightful in guiding the design of automation. The wing cut in poultry post processing is the most important part of the operation. This requires that first an incision be made that goes from the clavicle through the wing joint and down the scapula as shown in Figure 1. If this operation is done well, the breast fillet and underlying tenders can be removed with high efficiency. A typical wing cut utilises both visual and tactile cues.

The visual cues are used to locate and direct the initial cut point and trajectory (identifying a nominal trajectory). Once this process begins, it is driven by experience (a learned action) and the tactile feedback required to locate the joint and sever the surrounding tendons and ligaments and then glide down the scapula so as to leave as little meat as possible on the frame.

**Manipulation**

We will also have to address issues related to handling and manipulation. Here again, the human is unparalleled in terms of being able to function and adjust to variability. It is estimated that the hand can achieve more than seven billion different potential positions. While we might not require all these combinations for most tasks, more flexibility than currently available is needed.

“A major challenge we still face is with software that manifests itself in our ability to understand and make appropriate decisions based on sensor data.”

Currently, we can do well with motions and operations that are well defined to high levels of accuracy. We also now have the ability to control light-weight flexible machines that could make the devices much more cost-effective. Small motions requiring ‘feel’ are more challenging, and we need to devote time and resources to develop the software and hardware needed for this next generation of machines.

Many people can be trained to do the action described earlier and to do it well, but over long periods it is challenging to be consistent in performance as slight differences in shape and size make each operation somewhat unique, and in addition, the operators have to be mindful of poor cuts that could generate bones in the product.

Attempts have been made to automate this and similar operations, but it has been challenging to achieve the same level of overall performance as a well-trained production team. The main challenge is being able to respond to each individual product as well as being able to recover when things go astray.

One approach has been to sense and respond to the product as it is being manipulated. This is the requirement not only in cutting but also in many of the second and further processing operations. The approach is similar to the technique we believe is used by people in which a nominal trajectory is used that is then modified based on tactile feedback.

The approach then requires biological modelling, which is then used to generate trajectories. The device then begins the cut and monitors the forces to determine the corrections that might be necessary. It has been shown that it is possible to detect changes in the material being processed so that intelligent choices can be made.

**Future development**

The above examples illustrate approaches to one specific problem, but they also incorporate the essence of the solution to the general problem. We will have to improve on techniques for sensing and manipulation, and developments are underway that move us closer to the end goal. In the past, machine vision and computer imaging have benefited tremendously from developments made for the consumer market to support imaging on the internet and consumer cameras that have served to make these devices smaller and more affordable. A few years ago, most of the hardware cost surrounding this sort of equipment was in the electronics. Currently, there is typically more cost in the enclosures.
Presented to accommodate these applications are CAD tools to support the design of these devices for natural products. The missing links currently handling. This leads us to think about the tools needed to support the next generation of manipulators. The geometric relationships are important in many operations. In addition, we have to think of more general processes that require gripping and handling. This leads us to think about the tools needed to support the design of the next generation of manipulators. The missing links currently are CAD tools to support the design of these devices for natural products such as meat, fruit and other agricultural products. Approaches are being presented to accommodate these applications.

This would include CAD for natural products, which would allow for the incorporation of gripping systems as well as sensors for tactile feedback. The sensors could also double as devices to monitor food safety since they will handle or touch much of the product in any given operation. The requirements described earlier can be extended to the more general case where some additional operations need to be conducted on the object such as in cutup, trimming and portioning in slaughter operations that include second and further processing.

Summary
So what does the future hold? Smartphones, as an example, now have tremendous computing power along with the footprint and hardware that makes it possible to imagine leveraging this technology to operations of interest to us. 3D and other sensing technologies are becoming more affordable and are being used, for example, on game platforms thereby providing another leverage point. Software is one area that needs to see significant advances, but approaches are being developed that will pave the way to workable solutions. In addition, for many production operations, the machinery handles much of the product, so you can begin to envision sensors built into the devices to continually assess food safety challenges with the possibility for built-in mitigation mechanisms. Again, the development of tools to support the next generation of systems will be important. These systems will therefore have to have human capabilities but will be more consistent in performance over long periods of time. We will have in the end a close marriage between engineering and biology, which will then allow us to design integrated systems that fit your process like a good pair of boots. Developments are underway to provide workable solutions to meet industry needs in the operations of the future. This should be an exciting time; we just need to be able to make boots that fit.

Acknowledgements
The author would like to acknowledge the support of the State of Georgia that has sponsored, through the Agricultural Technology Research Program at Georgia Tech in cooperation with the Georgia Poultry Federation and its member companies, the poultry-related work described herein. Also, thanks to the many contributions of my colleagues in the Food Processing Technology Division of the Aerospace, Transportation and Advanced Systems Lab in the Georgia Tech Research Institute.

REFERENCES

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