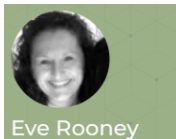


Introduction to Innovation Management

Team Ceiriog



Eve Rooney



Mike Davies



Bernie Lessimore



Adam Fairbank

Fig. 1(Mumby, 2022)

Eve Rooney- works at Dow Silicones in Barry as a facilities manager

Bernadette Lessimore- Commercial & Finance Manager for Synergy Plastics Limited

Mike Davies- works at Marelli Automotive Systems as a Senior Quality Engineer

Adam Fairbank- Marketing & Recruitment Manager from ION leadership, a leadership development programme based at Swansea University,

Learning Outcomes:

Demonstrate a systematic understanding of the key elements that contribute to successful innovation management processes.

Review

recent innovation history of chosen manufacturing, product development or service provision company.

Categorise

the innovation developments which have taken place in terms of Greg Satell's typology and analyse them in relation to:

1. Extent to which they have shifted the chosen company's market provision
2. Extent they have influenced the company's internal structures and management processes
3. Extent to which they have been technology dependent – and if so, which technologies
4. Consideration of the outcome of the innovation.



Fig. 2 (Dowling, 2013)

Team Ceiriog's chosen company: Dyson Ltd

'Enjoy failure and learn from it, you never learn from success.'

Sir James Dyson

James Dyson is an inventor, industrial designer and entrepreneur who has successfully manufactured a variety of innovative household appliances, the most well-known being the cyclone bagless vacuum cleaner.

His wife, Deidre Dyson said *'James' ambition was to make enough money... to pay for the next one... and look at him now... '*

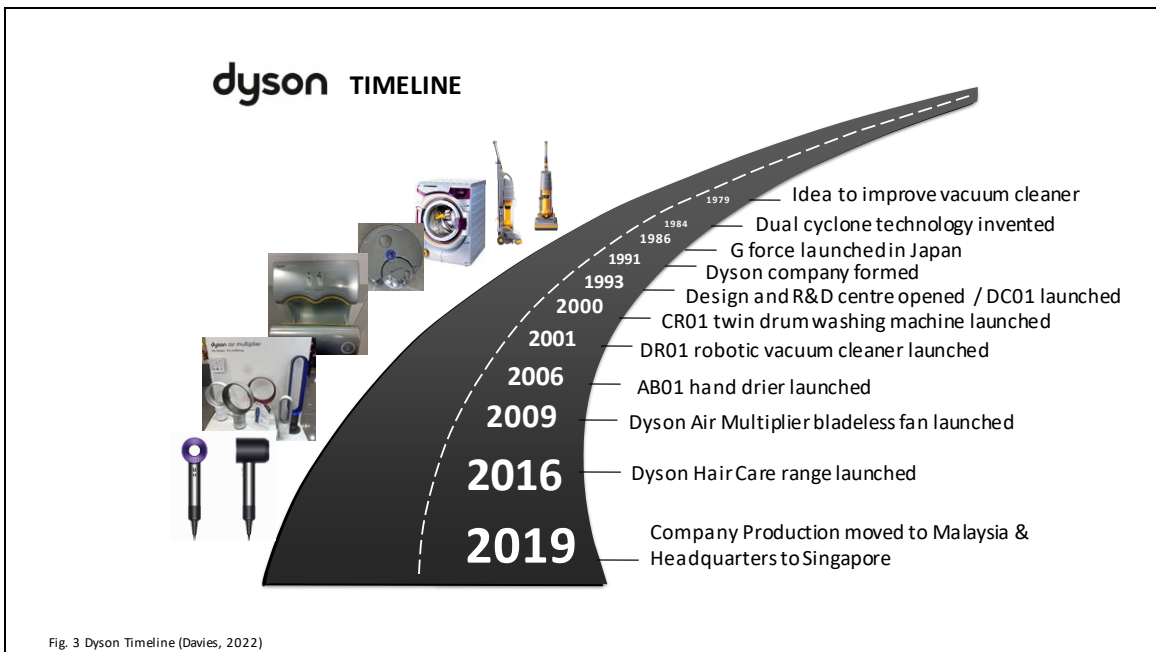
James Dyson studied at the Royal College of Art and whilst there discovered that he found how things worked and the technology inside it, was probably more interesting than design. He met Jeremy Fry, an engineer and managing director of Rotork and showed him a design he had been working on and Fry said *'that's very interesting but I'm not giving you any money for it....but I would like you to design a high speed landing craft'.....*Dyson did so and this was the first thing he ever made! He then had an idea for a 'ballbarrow' and realised if you design something well, even if its three times the price, people will want it. Whilst improving the ballbarrow **** Breakthrough Innovation**** Dyson started the first development of the cyclone

From Britannica –

In 1978 Dyson, having grown impatient with clogged air filters in his Ballbarrow factory, built a cyclone particle collector similar to devices used in larger industrial plants, such as sawmills. Makers of traditional bag-type vacuum cleaners showed no interest in Dyson's bagless device and he sold the cleaner, known as the G-Force, to a company in Japan, where it became a commercial success and won a design prize in 1991. In 1993 Dyson opened a plant in North Wiltshire, and within two years his Dual Cyclone model became the top-selling vacuum cleaner in Britain, despite a retail price considerably higher than that of competing brands.

The United States was in a recession when Dyson introduced the cyclone to the US, and analysts doubted that consumers would be able to justify spending \$429.99 on a vacuum. James Dyson disagreed. Speaking to the Times of London, he explained, "Vacuum cleaners are quite recession-proof because people retrench back into the home. If you look back historically, the sales don't drop at the time of recession." As evidence he mentioned Dyson's strong sales during the United Kingdom's recession in 1993.

Since 1993, Dyson's manufacturing locations have changed as the company has expanded with premises now all over the world and the vacuum cleaner has been developed further, with models being made from recycled plastic, engineered to sit on stairs, robotics, onboard computers, sensory devices and cordless cleaners introduced



Dyson products - washing machine that had 2 drums which rotated in opposite directions, thus simulating hand washing, developed hand dryers, hair dryers, led lighting with a low temperature so the bulbs can last up to 40 years, hair straighteners, have even assisted with a fashion show, using Dyson engineered wind tunnels, hoses and cyclones to make the models clothes - sway in the breeze, built a 15 acre glasshouse to grow strawberries in the UK all year round, thus reducing imports and helping the environment by reducing fuel costs etc and most recently developed air purifying headphones, that have filters to remove pollution particles.

Not all of Dyson's inventions have been a business success...

- The Ballbarrow idea was stolen by his Sales Manager and sold to a plastics company – Glassco who manufactured it under their own brand name.
- The twin drum washing machine & robotic cleaner were not commercial successes due to their price and therefore not selling high enough volumes to make them viable.
- James Dyson has revealed that his failed attempt to bring a seven-seat SUV electric vehicle (EV) to market cost him £500million of his own money.

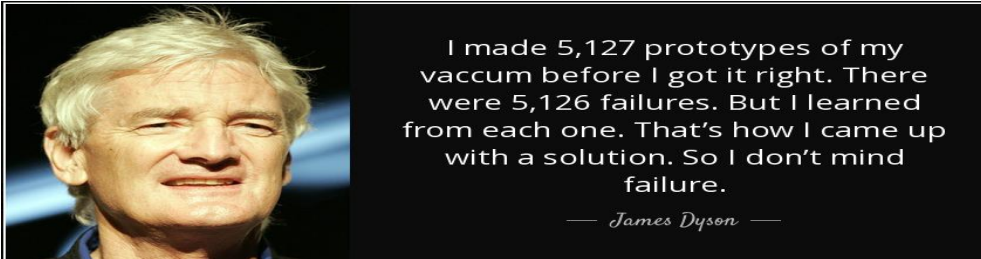


Fig. 4 Dyson(1993)

James Dyson – Honours, Awards, Foundation and Campuses

- **1996** - Appointed Commander of the Order of the British Empire
- **1997** - Received the Prince Phillip Designers Prize
- **2000** - Received the Lord Lloyd of Kilgerran Award & Awarded a D. Eng degree from the University of Bath
- **2002** - The James Dyson Foundation established
- **2005** - Appointed a Fellow of the Royal Academy of Engineering
- **2007** - Made a Knight Bachelor in New Year Honours
- **2015** - Elected a Fellow of the Royal Society of London
- **2017/2018** – Established engineering universities in UK

In 2007 James Dyson was knighted by the queen and became ‘Sir James Dyson’ for ‘services to business’, interesting to note that despite opening university campuses and his knighthood, Sir James Dyson has been criticised for producing in other countries outside of the UK, which now have the majority of the workforce for Dyson.



Dyson – 'The Fan'

'The Dyson Air Multiplier fan was a reinvention of air movement'
James Dyson

Fig 5 (Bowers, 2010)

How it works

Combined three scientific principles, which increases air velocity:

- **Coanda Effect** (aerofoil shape used to lift planes) - due to the curved shape, air speed is increased to compensate for -ve pressure created
- **Increasing cone diameter** - surrounding air drawn into rear of cone to compensate for -ve pressure created in expanded area
- **Viscous shearing** - draws in air surrounding the air stream, increasing the air stream velocity.
- Dyson calculates x15 increase in air velocity.

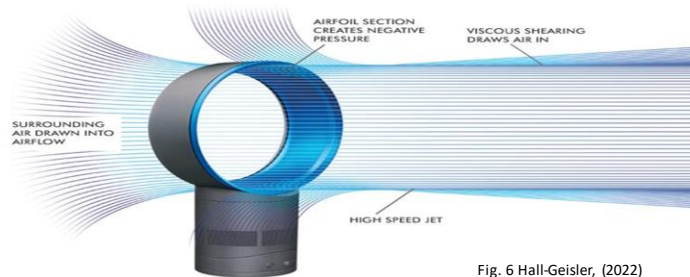


Fig. 6 Hall-Geisler, (2022)

Dyson released its first bladeless fan in 2009, inspired by the design of an aircraft wing, which produced a powerful stream of interrupted airflow without noisy and visible fast spinning blades.

The History of the Dyson Fan

- **2009** - The Dyson "Air Multiplier" is released
- **2011** - The Dyson **Hot fan heater** released, using the same Air Multiplier technology with a thermostat to control the temperature
- **2014** - Dyson released the Air Multiplier with improved motor greatly **reducing noise**
- **2015** - Dyson released the Air Multiplier Humidifier which **cleans water using "Ultraviolet Cleanse"** by running it through ultraviolet light twice before it is released
- **2016** - Dyson released the Dyson Pure Cool air purifier which uses the same Air Multiplier technology to blow air but **traps more particles/pollutants** than previous models.
- **2020** - Dyson **discontinued basic cooling fans for fan air purifiers**, some include heating
- **2021** - Dyson launches the AM02 and AM03 fan models which **amplify the air more for improved airflow**
- *'The new machines are engineered to circulate smooth un-buffed air in larger rooms. They draw in and multiply nearly 50% more air than our desk fan' says Sir James Dyson.*

Dyson AM02 Tower fan specifications:

AM02 Tower is slender and running track shaped to take up limited floor space. Drawing in nearly nine gallons of air per second, the machine amplifies the air 16 times creating a smooth and cooling airflow.

Dyson AM03 Pedestal fan specifications:

Offering the most airflow of all Dyson Air Multiplier™ fans, the AM03 Pedestal takes in nearly nine gallons of air per second and amplifies the air 18 times. Unlike other pedestal fans, which use an awkward clamp to fix the height, AM03 Pedestal uses a constant rate Tensator spring to easily push or pull the loop amplifier to set the height and angle. The machine extends nearly nine inches for use in larger areas including living rooms and offices. It has no spinning blades, is easy to adjust and tilt.

Greg Satell Typologies

DYSON LIMITED

BREAKTHROUGH INNOVATION	SUSTAINING INNOVATION Road Mapping R & D Labs Dyson Institute of Engineering Dyson Foundation
BASIC RESEARCH	DISRUPTIVE INNOVATION Fan design had used same technology for almost 100 years. The fan market was disrupted by the radical looking design of the Dyson Air Multiplier with no visible blades & improved performance .

Fig. 7 (Satell, 2017)

We have reviewed The Dyson Fan using Greg Satell Matrix

As a team we have established that the Fan fitted well into sustaining and disruptive innovations, I will cover the follow points as we go through the slides.

Sustaining Innovation

Dyson continually works to improve its products and as Satell states 'every technology needs to get better' (SATELL, 2017). In terms of Research and Development, in the most recent years we have seen:

- Dyson opened a Research and Manufacturing site in Malmesbury in 2016
- The following year, in 2017 Dyson opened the first of its kind for the company, a Technology Centre in Singapore to partner its site in the UK, bringing technology and intelligence together.

Dyson said it wanted to move towards a '24-hour research and development cycle' so that designers and engineers can work across both sites to develop ideas faster (Banks, 2017).

It's at sites like this that in 2014 Dyson redesigned the Air Multiplier.

If we look at Sustaining Innovation first.

Dyson is known to continually improve its products and as Satell states "every technology needs to get better." Dyson are determined to keep moving forward in terms of R & D , in the most recent years we have seen:

- Dyson open a Research and Manufacturing site in Malmesbury in 2016
- And In the following year, Dyson opened A Technology Centre in Singapore bringing technology and intelligence together.

It's at sites like this that in 2014 Dyson had to redesign the Air Multiplier.

Since launching the original fan in 2009, Dyson received numerous complaints about the noise the fan generated.

The original fan was designed to allow the airflow to be sucked through the small vents at the base, propelling air through the hollow, circular frame, however, the air would propel to the centre of the circular base causing a turbulence which in turn made the motor louder. In an article from the BBC, James Dyson states the company spent £8.5m on R&D on the AM01 Fan, taking over 4 years to re-design. (BBC, 2013)

Original Fan –2009



Revised Fan - 2014



Fig. 8 Hall-Geisler, (2022)

Since launching the original fan in 2009, Dyson received numerous complaints about the noise the fan generated.

As we see on an imagine shown, the original fan was designed to allow the airflow to be sucked through the small vents at the base, propelling air through the hollow, circular frame, however, the air would propel to the centre of the circular base causing a turbulence which in turn made the motor louder.

Dyson stated in an article via the BBC the company spent £8.5m on R & D on the Fan, taking over 4 years to re-design .

An article written by the Gazette & Herald (Herald, 2014) states the technology within the redesigned fan is up to 75% quieter than the original model. It took a team of 65 engineers to reduce the turbulence of high velocity air. They introduced Helmholtz in the cavity of the base which eliminates 1,000 Hz, similar to the frequency of the noise produced by the wing beat of mosquitoes. Helmholtz cavity catches sound waves travelling through the machine. When air is forced into the Helmholtz, the pressure inside increases. These sound waves are then bounced within the cavity, dissipating the sound and in turn improving the tone of the machine.

Alongside this a further article was published which stated the technology within the redesigned fan is now up to 75% quieter than the original model and It took a team of 65 engineers to reduce the turbulence of high velocity air. They introduced Helmholtz in the cavity of the base which eliminates 1,000 Hz, To explain, Helmholtz cavity catches sound waves travelling through the machine. These sound waves are then bounced within the cavity, dissipating the sound and in turn improving the tone of the machine.



Fig. 9 Dyson institute, (2017)

Dyson continued to focus on R&D and in 2016 James Dyson asked the Minister of Universities – Jo Johnson MP, what the government were doing about the engineering skills crisis. Jo responded with a challenge, that James should set up his own higher education provider for aspiring engineers (Institute, About Us, 2022), following this challenge, in 2017 the company opened the Dyson Institute of Engineering. Offering approximately 40 undergraduates per year the opportunity to study. The institute was opened with the vision to become the best university in the world and to develop engineers of the future. Not only is Dyson developing new technology and transforming how products work, Dyson is also now transforming education.

Dyson continued to focus on R & D and in 2016 he raised a question to a local MP, Jo Johnson – he asked what the government were doing about the engineering skills crisis. Jo responded with a challenge, that James should set up his own higher education facility and following this challenge, in 2017 the company opened its doors to the Dyson Institute of Engineering. Offering approximately 40 undergraduates per year the opportunity to study. So now not only is Dyson developing new technology and transforming how products work, Dyson is also now transforming education.

Satell writes, while researchers expand horizons by discovering new phenomena, engineers harness those phenomena to create novel solutions to important problems, it's at this point that we recognise scientific discoveries as potentially being useful (SATELL, 2017). This is the case above, whilst the original fan would have been thoroughly researched prior to the launch in 2009, in 2014 the engineers took control of the evident problems and created a necessary solution.

Like most large companies, Dyson has a strategic road mapping process in place to ensure that continuous improvements are made, upgrading products on a regular basis as a result of customer satisfaction. The company is known for developing products that are new and improved.

Dyson also has an expansion of the Institute of Engineers in the form of The James Dyson Foundation. The foundation partners with top universities and supports students with new ideas and encourages them to think differently and to realise making mistakes helps an individual to realise their engineering potential.

Its within Satell's matrix that he mentions, while researchers expand horizons by discovering new opportunities, engineers harness those opportunities to create solutions to important problems, This is the case above, whilst the original fan would have been thoroughly researched prior to the launch in 2009, the engineers in 2014 took control of the evident problems and created a necessary solution.

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Disruption Innovation

No blades. No buffeting. No stopping us.

Dyson released its first bladeless fan in 2009, inspired by the design of an aircraft wing. The invention of Dyson Air Multiplier Technology™ disrupted the air treatment industry as Dyson's AM01 fan was able to produce a powerful stream of uninterrupted airflow without noisy and visible fast spinning blades. (Dyson, 2022)

James Dyson explains that the original air treatment in terms of the electric fan has not changed since 1882. Schuyler Wheeler, a 22-year-old American engineer whose real invention was the electric lift, made the first known version of the fan. He went on to say, 'Conventional fans have the heavy motor at the centre of the fan, which makes them top heavy and continually slumping on their angle adjustment mechanism'.

Moving on to Disruption Innovation

No blades. No buffeting (irregular oscillation). No stopping us

Dyson's website tells us, that it released its first bladeless fan in 2009, inspired by the design of an aircraft wing. The invention of Dyson Air Multiplier Technology™ disrupted the air treatment industry as the new fan was able to produce a powerful stream of uninterrupted airflow without being noisy and visible fast spinning blades - however, based on our findings in the sustaining section we know this was not the case, as it was indeed noisy at first

Dyson explains that the original air treatment in terms of the electric fan have not changed since 1882, Dyson compared the fans as follows:

- Conventional fans have the heavy motor at the centre of the fan

Disruption Innovation

- However, on the Dyson fan the motor is in the base, with the centre of gravity around the middle of the base, this allows Dyson to rotate the fan around an arc from its centre of gravity. This means that at whatever angle you chose for a position, it would stay there perfectly balanced without the need for fixing or clamping.

However, on the Dyson fan the motor is in the base, with the centre of gravity around the middle of the base.

Left: Dyson patent (2009) and
right: Tokyo Shibaura patent
(1981) CREDIT: Photo: UK
INTELLECTUAL PROPERTY OFFICE

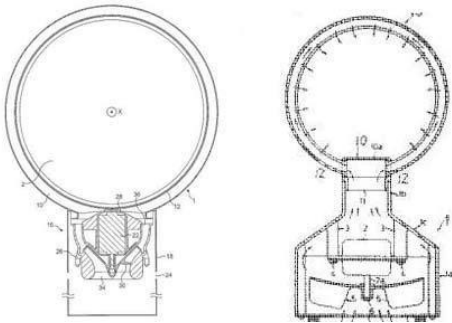


Fig. 10 (Wallop, 2009)

Satell outlines that established companies, with entrenched assets and obligations to existing customers, must eventually learn to disrupt themselves. They need to figure out which parts of their existing business model to keep and which to throw away. (SATELL, 2017)

Dyson used the technology itself as part of their business model as the disruptor as it has improved existing cooling and heating fans. Even whilst it's known that the first bladeless fan was produced in 1981 by Toshiba in Tokyo, Dyson changed a key design element and introduced a Coanda Surface.

This is the aero foil ramp over which the air is pushed out of the ring of the fan. Because of the angle of the Coanda surface, the air sucks surrounding air into the air-flow, creating a smooth and powerful blast of air. Dyson confirmed to the patent department that even though the Japanese arrangement of the fan looks very similar, the technology is different. (Wallop, 2009)

Looking at disruption a bit further, Satell outlines that established companies, must eventually learn to disrupt themselves. They need to figure out which parts of their existing business model to keep and which to throw away.

Dyson used the technology itself as part of their business model as the disruptor as it has improved existing cooling and heating fans. Even whilst it's known that the first bladeless fan was produced in 1981 by Toshiba in Tokyo, Dyson changed a key design element and introduced a Coanda Surface.

Dyson confirmed to the patent department that even though the Japanese arrangement of the fan looks very similar, the technology is very different .

I'll now pass this over to Mike

The Dyson Air Multiplier broadly fits into the Satell Matrix quadrant for Disruptive innovation at initial product launch & Sustaining innovation with its continual improvement program.

A review was conducted on the principles and strategies of other leading innovation gurus:

The following section compares the work of:

- Paul Trott
- Peter Drucker
- Kenneth B. Kahn
- Tidd and Bessant.

Blank Intentionally

Paul Trott

In Paul Trott's book *Innovation-Management-and-New-Product-Development*, which is split into three parts:

Part One Innovation management

Outlines how to create a venture, turning technology into businesses and link entrepreneurship and innovation.

Part Two Turning technology into business

Identifies how to grow ventures and make them profitable, exploring the early development of academic spin-offs and adapting technology to meet customers' needs.

Part Three New product development

Reviews the day-to-day running of a business; and how to develop new products and services.

Considered as a guideline on how to turning technology based ideas into a successful business, and readers to understand entrepreneurship, management and innovation.

Trott states the use of information flows is used to explain how innovations transpire. The overall innovation process can be thought of as a complex set of communication paths and include internal and external linkages.

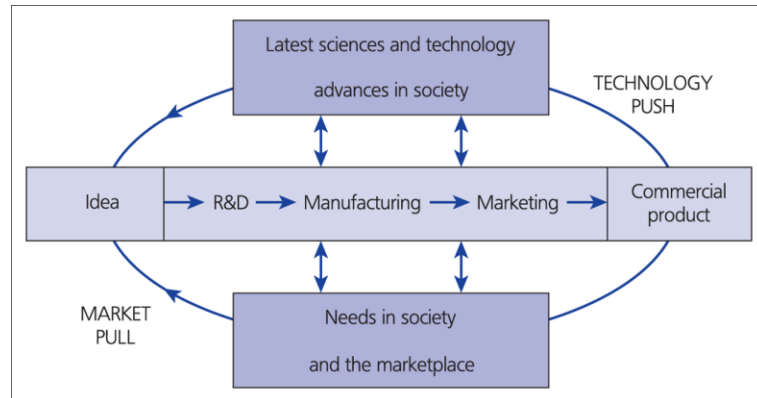


Fig. 11 Interactive model of innovation (Trott,2017)

Trott states the use innovation process can be thought of as a complex set of communication paths and include internal and external linkages.

This Model followed by the automotive industry in new product launches

Trott's typology of innovation, has 3 types of product innovation

(New Technology Creation, Core Product Enhancement, New Products for business impact)

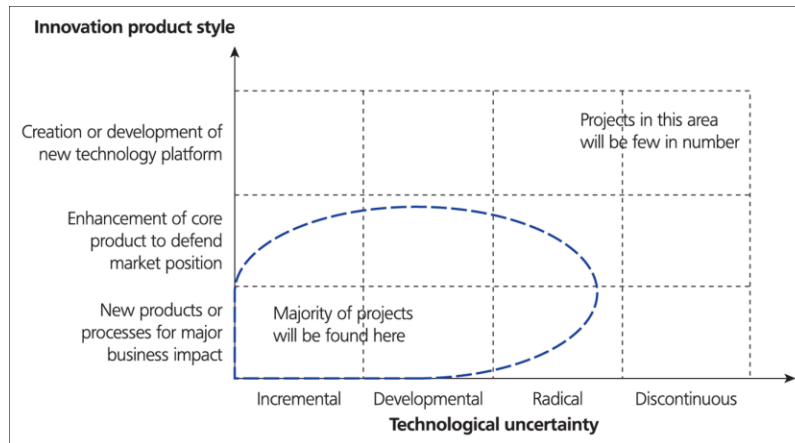
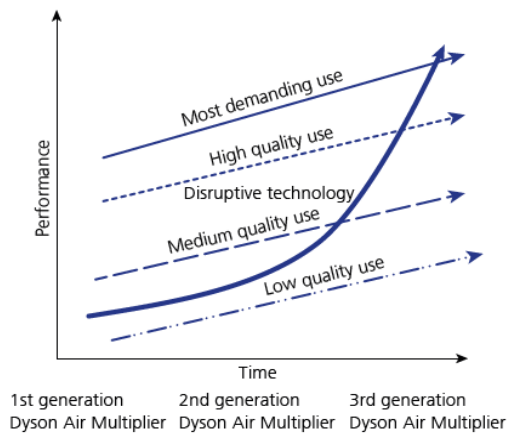


Fig. 12 A two-dimensional typology of innovation projects
(Trott, 2017)

The Air Multiplier would be considered as New Technology Creation innovation with radial technology uncertainty at product launch

Trott actually uses the Dyson Air Multiplier as a case study to show the concept of dynamic competencies used to enable disruptive technologies.



How dynamic competencies help a firm adapt to disruptive technologies?

Fig. 13 Disruptive Technologies

The domestic fan market was a mature technology,

With low, medium, high & specialised market segments.

In 2009 Dyson launched the air multiplier

It did not appear to have any visible blades & did not buffet the air.
Initially noisy and had limited power, hence it begins life towards the bottom of the performance vertical scale.

The 2nd generation product was quieter and had superior digital motors, moving up the performance scale.

With continual improvements, it disrupted the whole industry.

Peter Drucker

Peter Drucker in his book INNOVATION AND ENTREPRENEURSHIP Practice and Principles states there are four specifically entrepreneurial strategies:

1. Being "Fustest with the Mostest"
2. "Hitting Them Where They Ain't"
3. Finding and occupying a specialized "ecological niche"
4. Changing the economic characteristics of a product, a market, or an industry.

1. "Being "Fustest with the Mostest";
2. "Hitting Them Where They Ain't";

Two completely different entrepreneurial strategies, summed up by another battle-winning Confederate general in

America's Civil War, who said: "Hit Them Where They Ain't." They might be called Creative Imitation and Entrepreneurial Judo, respectively

Creative Imitation

Do something somebody else has already done in a new way or use in new application, entrepreneur understands what the innovation represents

Entrepreneurial Judo

- use of other competitor's strengths and weight against them is the judo principle transferred to economic life.

Established businesses, who become rigid in their practices & processes allowing market openings to be exploited

This is a repeat of Clayton Christensen disruptive innovation theory

This aligns with Dysons Air Multiplier invention, disrupting the traditional fan market

The fan had not changed for so long, allowed Dyson to create something that appeared totally novel.

Dyson has continued to develop the Air Multiplier technology, acoustically re-engineering it to be significantly quieter.

The product's original advertising emphasised it's safety benefits of the product by James Dyson placing his hand in the fans aperture

later adverts placed the fan next to a sleeping baby to highlight the reduced noise of the fan in use.

3. Finding and occupying a specialized "ecological niche";
4. Changing the economic characteristics of a product, a market, or an industry.

Kahn

In Kahn's Understanding Innovation, he states 'one must recognize that innovation is three different things:

1. innovation is an outcome
2. innovation is a process
3. innovation is a mindset'.

Innovation as an outcome emphasizes what output is sought, including product innovation, process innovation, marketing innovation, business model innovation, supply chain innovation, and organizational innovation.

Innovation as a process attends to the way in which innovation should be organized so that outcomes can come to fruition; this includes an overall innovation process and a new product development process.

Innovation as a mindset addresses the internalization of innovation by individual members of the organization where innovation is instilled and ingrained along with the creation of a supportive organizational culture that allows innovation to flourish.

To launch the air multiplier, Dyson recognised & understood these 3 principles

Tidd and Bessant 4P space model was also reviewed

The Dyson Air Multiplier would be classed as radical innovation at product launch, then incremental innovations with new model launch due to continual improvement (no change to the other 3 Ps)

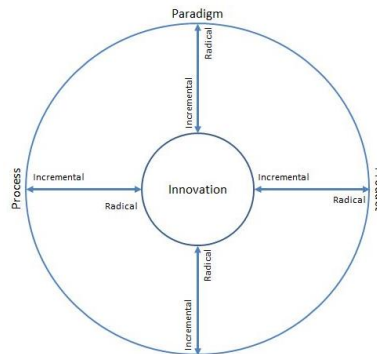


Fig 14 Tidd and Bessant 4p space model
fig. 1: The 4 P of Innovation (Tidd&Bessant 2013)

The Air multiplier would have been radial product innovation at launch,

Pros & Cons of Tidd and Bessant 4Ps of innovation process model

Pros

Good tool to promote discussion within a company to where innovation is taking place and also how much

Cons

Issue with Overlap of quadrants and no clear boundaries between incremental & Radical, also definition of new needs to be defined by the company

New technology?

- Not previously used

- New to company, but used by competitors

- New to industry, but known technology in other industries

Conclusion

James Dyson could be considered an intrapreneur as per Gifford Pinchot III definition [entrepreneur within an organisation].

He has 'offloaded' all the management of his company to others, so he can concentrate on innovation & product development.

Interestingly ISO have a new standard at draft stage ISO 56001 on Innovation Management Systems, which seems to regulate innovation methodology which is a contradiction to the true meaning of innovation.

The extent to which they have shifted the chosen company's market position

- Dyson were already well established in the household appliances market, and in 2006 they entered the hand-dryer market.
- However, the hand-dryer technology has more than one use:

'As often happens, our observations during the development of the Dyson Airblade hand-dryer led us to principles used in other products, like our Air Multiplier fans, and in turn, to heaters, humidifiers and air purifiers. One thing we noticed in our research into airflow was the way in which the ultra-high velocity blade of air that prompted us to make the hand dryer could induce a lot of additional air behind it'. (Dyson, 2022)

- The Dyson Air Multiplier was a new entrant to the fan market, really disrupting the market.

- Dyson were well established in the household appliances market, and had recently entered the hand-drier market
- Principles used in the hand-dryer, namely a greater understanding of airflow, were used in a number of other products, including the Air Multiplier fan.
- The Dyson Air Multiplier was a new entrant to the market, really disrupting the market
- Fan design hadn't really changed since 1882, when Schuyler Wheeler designed the first fan
- As we will discuss later, Dyson's technological developments were ground-breaking, being the first real 'innovation' in the fan market in 117 years.
- As James Dyson said; "The Dyson Air Multiplier fan was a reinvention of air movement"

- James Dyson goes on 'Electric fans were of a design that has remained basically the same since 1882, when Schuyler Wheeler, a 22-year-old American electrical engineer, whose real invention was the electric lift, made the first known version. (Dyson, 2022)
- So, when the Dyson Air Multiplier was launched in 2009, it was the first real 'innovation' in the market for 117 years.
- 'The Dyson Air Multiplier fan was a reinvention of air movement.' (Dyson, 2022)

The extent to which they have influenced the company's internal structures and management processes

- James Dyson does not like being described as a 'businessman', preferring to be seen as a designer, an inventor and a champion for British manufacturing industry'. (Piercey, 2002)
- Dyson have a very flat management structure. James Dyson believed 'This helped to empower individuals to take decisions quickly and get things done. We had all the right people around the table and they knew their role'. (Dyson, 2022). He continues, "'Having such a clear purpose, understanding and direction allowed our people to use their expertise to maximise effect.'
- Dyson take a holistic approach when it comes to internal structures - designers, sales and production all working together.
- 'Innovative teams need leadership which encourages discovery and learning, tolerates risk and failure'. (Price 2022)

- James Dyson doesn't see himself as a businessman. He sees himself as a designer, inventor and champion of British manufacturing.
- Dyson have a very flat management structure. All offices are open plan, teams innovate openly, are encouraged to share ideas and talk to each other, rather than send emails. Dyson believes in the human interactions.
- Dyson believes that the flat structure empowers colleagues to make decisions quickly and believes in creating an environment for people to use their expertise to maximum effect
- Dyson take a holistic approach when it comes to internal structures - designers, sales, production, all working together
- The company (and founders) philosophy plays a huge part in creating an environment, and structure, in which innovation can flourish
- the growth of the business is based on creativity and rule-breaking, with staff openly sharing ideas, and a clear core function of "outrageous suggestions".
- This approach and philosophy should be easy in a smaller organisation, but could be increasingly difficult to manage in a large organisation. However, Dyson says he will "sub-divide the business into new sections around new products as they come along".

The extent to which they have influenced the company's internal structures and management processes

- The company philosophy plays a huge part in creating an environment in which innovation can flourish.
- 'The growth and development of Dyson's business is characterized by creativity and 'rule-breaking' (Piercey, 2002)
- 'Dyson also believes in staff freely sharing ideas. That's why his design-engineering floor is entirely open plan'. (Wired, 2011)
- 'To calibrate the business to tackle design problems, Dyson has imposed a clearly defined corporate philosophy. Its core function is to encourage 'outrageous suggestions'. (Wired, 2011)
- 'The company faces the problem of maintaining its culture while growing fast. However, when challenged that his informal, open, creative company will become a suit-wearing bureaucracy as it becomes bigger. Dyson says he will avoid this by sub-dividing the business into new sections around new products as they come along'. (Piercey, 2002)

The extent to which they have been technology dependent – and if so which technologies

- As mentioned earlier, 'observations' during the development of the hand-dryer, led to technology developments which could be used on other products.
- The fan's development was based very heavily on technology, disrupting the air treatment industry.
- There were 2 main technological developments:

1. No blades:

- Dyson identified that 'a small blade of high-speed air exits, in our case from an annulus (a narrow slot for air to exit that extends the whole way around the diameter of the hoop), it induces a region of low-pressure air, or suction, from behind it. Thus, from quite a small volume of airflow you can create one many times larger. Air drawn into the base of the Dyson Air Multiplier fan at 27 litre a second by our motor passes over its aerofoil-shaped ring, creating low pressure, or suction, that pulls air from behind and multiplies its flow to 405 litres a second'. (Dyson, 2022).

- Observations during the development of the hand-drier, namely discoveries in terms of air-flow, were used in the development of the fan
- the fan's development was hugely dependent on technological developments, developments which hugely disrupted the air industry
- There were 2 main technological developments:

1. No blades

- Dyson produced the first fan with no blades
- The fan produced a powerful stream of uninterrupted airflow through a circular head that blew air out of tiny holes dotting its perimeter
- Dyson found that from a small volume of airflow, you can create one many times larger
- Therefore, air drawn into the base at 27 litres per second, was multiplied to 405 litres per second.

2. Motor

- conventional fans had the motor at the centre of the fan, seriously impeding airflow.
- Dyson changed the position of the motor, placing it in the base, meaning they could

rotate the fan around an arc from its centre of gravity. Therefore, however you positioned the fan, it would be balanced.

A drive for perfection

- the first fan was deemed too noisy, so after various new iterations and testing, the new fan was 75% quieter than the previous generation. However, it wasn't completely silent, something which the engineers kind of thrived upon, as it gave them something to strive towards.

- As John Baptiste, a sound engineer at Dyson said, "When we release a new product, you can be sure we're already working on the next generation. And maybe even the next generation after that".

The extent to which they have been technology dependent – and if so which technologies

2. Motor:

- Having no blades was a fantastic technical development, however, conventional fans have the motor at the centre of the fan, which would seriously impede airflow.
- Dyson changed the position of the motor. As James Dyson explains, 'On our fan the motor is in the base, with the centre of gravity around the middle of the base. We found that we could rotate the fan around an arc from its centre of gravity. This meant that at whatever angle you chose for a position, it would stay there perfectly balanced without the need for fixing of clamping'. (Dyson 2022)

It's all about perfection

- The first iteration of the blades were still deemed too noisy, so they redesigned them. The new Air Multiplier is 75 per cent quieter than the previous generation, a substantial decrease in noise.
- Dyson are constantly striving for perfection. As John Baptiste, a sound engineer at Dyson said, 'When we release a new product, you can be sure we're already working on the next generation' he says. 'And maybe even the next generation after that.' (Wired, 2014)

A consideration as to the outcome of the innovation

- Time Magazine (2009) voted the fan third in the Top 10 everything of 2009.
- However, as Satell (2017), said 'it's important to continually innovate how we innovate'.
- The Dyson Air Multiplier was discontinued in 2020, in favour of an extended range of combination fan air purifiers, some with optional heating.
- As Trott (2016) discusses, 'Dyson invests heavily in R&D and believes that this is a key to success. The high value he places on creativity sets Dyson apart from other firms and helps to explain his insistence on maintaining what, in Britain, are considered insanely large annual investments in research and developments. Nearly 17 percent of revenues regularly goes to supporting the company's R&D effort, a figure ten times greater than the average in the United Kingdom'.
- As discussed earlier, it's all about the product, it's not about the money.
- According to Piercey (2002), when James Dyson is challenged about his company's financial success, his response is that 'The beauty of making a lot of money is that it allows you to do more expensive research and development that will help you to make even better products'.

- The fan was a technological success, it disrupted the market
- Time magazine voted it 3rd in the 'Top 10 of everything 2009' and according to Dyson (remember), it "reinvented air movement".
- As Satell says "It's important to innovate how we innovate", so in 2020, the fan was actually discontinued, in favour of an extended range of combination air purifiers and heaters.
- Technology, and customer needs, had moved on.
- The continuous learning that Dyson take from every innovation, and the emphasis Dyson place on R&D, is the lifeblood of the business, and leaves a legacy that means Dyson will continue to innovate and disrupt markets for years to come.
- Annual investments in R&D at Dyson are up to 17% of revenues, 10 times greater than the average in the UK.
- As James Dyson, it's not about the money. It's about the product.
- Dyson believes that the "beauty of making a lot of money is that it allows you to do more expensive research

What everyone contributed to the review

The team set up a Teams Chat room & folders for everyone to upload information and supporting data on James Dyson & the Dyson Air Multiplier.

All team members contributed equally to the background research, the presentation was divided into 4 sections and each team member was delegated a section to prepare:

1. Introduction to James Dyson & background data on Dyson Ltd including selection of product to be investigated – ***Eve Rooney***
2. A review of the Dyson Air Multiplier in regard to Satell's Typologies - ***Bernie Lessimore***
3. A comparison of Satell's Typology to other leading innovation guru's principles and strategies of innovation – ***Mike Davies***

What everyone contributed to the review

4. Demonstrate how the Dyson Air Multiplier
 - Shifted Dyson's market provision
 - Influenced Dyson's internal structures and management processes
 - The Air Multiplier's technology dependency
 - A consideration of the outcome of the innovation - ***Adam Fairbank***

What we have learnt whilst undertaking this assessment:

Bernadette Lessimore

On starting this course/assignment, I will admit I always thought of innovation as a small team of people in a cupboard like office, coming up with new product ideas and from there projects would start to progress.... Whether they are successful or not.

However, this is not the case as I have learnt innovation is not only about new products, but in fact it's about the creation, modification and improvements of products. For a company to remain competitive in the current market and profitable it must be innovative.

James Dyson shows us that even without an engineering degree you can be innovative, as long as you have the right people around you, and this is evident by the many successful products he has brought to market. Innovation is about companies adapting and overcoming challenges and as Satell writes, it's about defining the problems and deciding who is best to solve them. I think it's been a great start to my journey through innovation and I look forward to learning more about this subject.

Adam Fairbank

- As someone who works in people development, I am very interested in the role of people in the innovation process.
- What I found most interesting was the importance of the culture within Dyson – a culture of ‘outrageous suggestions’ (Wired, 2011), ‘creativity and rule breaking’ (Piercey, 2002). And that culture that comes from the top.
- What I have also learnt is that all innovations don’t need to be new innovations. Observations during the development of the airblade led to principles being used in other products, including the fan. The fan was discontinued in 2020, in favour of a range of combination fan air purifiers. An evolution of the technology from the hand drier, through to the Air Multiplier and beyond. Interesting insight into the innovation cycle.
- My final key learning is the importance of having a portfolio of innovations. With just one innovation within the matrix, all the risk is placed on that innovation. It is far more advisable to spread the risk by having a mixture of innovations at different stages of the matrix. As Satell said in the Harvard Business Review, ‘we need to build up a portfolio of innovation strategies designed for specific tasks’. (Satell, 2017)

Eve Rooney

- I have learnt even more the importance of teamwork, especially after the talk from Andrew Price where lack of teamwork was a finding in a hospital investigation, and it cost lives. Creating a team with the right people, the right skills and the right attitude can then improve innovation ideas and enable success for a private business or public sector. Dyson originally didn't have a recognised management structure of a team of i.e. production manager etc, Dyson had a group of engineers that eventually produced a product that normally would have had a full production line of personnel, they adapted to complete the mission – as a team. James Dyson does not recognise designers, engineers and mathematicians etc working separately, he has all working together and this has created an effective 'team' and therefore a successful business.
- I have learnt that innovative, successful products can be brought about by developing 1 product and stumbling onto another! James Dyson developed the first 'cyclone' from getting frustrated with clogged air filters in his ballbarrow factory... then developed the 'bagless' vacuum. Being willing to adapt, think 'out of the box', being open, flexible to new ideas and travel a new path can sometimes be the key to success. Also, never to 'sit still' and continuing to have the drive to improve and make things better. James Dyson has continued to develop and improve the vacuum cleaner and the fan with great results and thus also keeping his business profitable.

Eve Rooney continued

- I have learnt that recognised organisational cultures such as 'Power', 'Role', 'Team' and 'Individual', can be prevalent throughout organisations, so for example, even if primarily the organisation seems to be a 'role' culture, departments or teams within the organisation can work to one of the other 3 cultures. This can be positive or negative depending on the task at hand. Whilst reading the history of Dyson Ltd, Dyson seems to have gone through, individual, team and role culture at different times during the journey and all have aided in his success at the time.
- Lastly, that there is no definitive 'right way' for innovation, successful products or successful businesses and it doesn't always have to be technology that provides the solution - as with the 'Tetley' tea bag change from square bag to round... who would have thought such a 'simple' change would make Tetley the world leader in teabag sales for a long time!

Mike Davies

Prior to starting this course my original thoughts on innovation were the stereotypical eureka moment and having an engineering background, I thought innovation was only new types of products or processes.

I have learned of the different types of innovation, as explained in Satell's typology and can now see that the successful companies are working on 3 levels, maintaining current business, continual improvement programs (sustaining innovation), and long-term R&D programs (moon shots) [70-20-10 rule].

I found the James Dyson assignment a learning exercise in teamwork, and it was refreshing to hear experiences and opinions, which were outside my normal workplace discussion, which are very quantitative in nature.

Mike Davies continued

Ironically, a lot of tools & techniques recommended by innovation leaders are taken from other disciplines – so the teaching of innovation theory could be considered disruptive innovation in nature with tools and techniques being transferred to be used in new fields i.e.

- Joe Tidd recommends use of Quality Function Deployment (QFD) [Prof. Akao House of Quality].
- Paul Trott in his paper “Risk governance approach to migration: a viable alternative to precautionary management” basically describes the automotive FMEA process.
- Peter Drucker’s Creative Imitation outlines the reverse engineering process.

Figure Table

- Fig. 1 Mumby, A. (2022) [Student Biog's Oct 2022] (Accessed: 30 Oct. 2022).
- Fig. 2 Dowling, S. (2013) [Getty Image] available at <https://www.bbc.com/future/article/20130312-failure-is-the-best-medicine>
- Fig. 3 Davies, M. (2022) Dyson Timeline Infographic
- Fig. 4 Dyson, J. Quote (1993) AZ Quotes available at <https://www.azquotes.com/quote/751441>
- Fig. 5 Bowers, M. (2010) available at <https://www.thetimes.co.uk/article/multiplier-helps-to-double-dyson-profits-6d9fnkgtrr>
- Fig. 6 Hall-Geisler, K & Chandler, N. (Updated: Jun 13, 2022) How stuff works available at <https://electronics.howstuffworks.com/gadgets/home/dyson-bladeless-fan.htm>
- Fig. 7 In Printed book: Satell, G. (2017) Typologies
- Fig. 8 Hall-Geisler, K & Chandler, N. (Updated: Jun 13, 2022) How stuff works available at <https://electronics.howstuffworks.com/gadgets/home/dyson-bladeless-fan.htm>
- Fig. 9 Dyson institute, (2017) available at <https://www.dysoninstitute.com/about-us/our-story/>
- Fig. 10 Wallop, H. (2009) Patent photo available at <https://www.telegraph.co.uk/technology/news/6377644/Dyson-fan-was-it-invented-30-years-ago.html>
- Fig. 11 In Printed book: Trott, P. (2017) Interactive model of innovation Management and New Product Development. London. Pearson p. 25
- Fig. 12 In Printed book: Trott, P. (2017) A two-dimensional typology of innovation projects Innovation Management and New Product Development. London. Pearson p. 123
- Fig. 13 In Printed book: Trott, P. (2017) dynamic competencies used to enable disruptive technologies Innovation Management and New Product Development. London. Pearson p. 233
- Fig. 14 Tidd and Bessant 4p space model (2014) innovation masters: Mapping Innovation Space: 4Ps [video]. Available at <https://www.youtube.com/watch?v=Hx6Y08xp3DQ> (Accessed: 4 November 2022)

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