

Impact case study (REF3b)

<p>Institution: London South Bank University</p>
<p>Unit of Assessment: Sport and Exercise Sciences, Leisure and Tourism</p>
<p>Title of case study: The development of column-based mid-sole ('Microwobbleboard'TM) technology, leading to the creation of FitFlop Ltd, a global footwear brand.</p>
<p>1. Summary of the impact (indicative maximum 100 words) Research carried out by the SESRC has resulted in a new category of health and wellness footwear which has been commercialised by FitFlop Ltd.</p> <p>Since 2008, the Company has:</p> <ul style="list-style-type: none"> • Achieved sales of over 17million pairs of FitFlopTM footwear, generating revenues of \$350million; • Increased its worldwide workforce from 17 (in 2008) to 160 (2012); • Expanded its operations into 52 countries with sales operations in the UK, France, Italy, Spain and the USA; • Grown from a single to a multi-product footwear manufacturing and retail brand; • Received the Seal of Acceptance from the American Podiatric Medical Association (APMA), and won business awards in 2011 and 2012.
<p>2. Underpinning research (indicative maximum 500 words)</p> <p>Research carried out by the Sports and Exercise Science Research Centre (SESRC) since 2001 in the area of biomechanics and motor control of human movement has resulted in a body of knowledge and expertise being accumulated. The research continues to be led by Dr Katya Mileva (Senior Research Fellow, 2001 - to date) in collaboration with Dr David Cook (Senior Lecturer, 2003 - left LSBU 2012) and Dr Darren James (Research Assistant, 2004 - 2012 and Research Fellow, 2012 - to date).</p> <p>Specifically, research has explored interventions designed to promote gait efficiency via modulation of the impact force during walking. Research since 2004 has demonstrated altered temporal movement patterns when wearing footwear compared to barefoot walking [1]. Further experimental studies have demonstrated that electrical stimulation of intrinsic foot muscles [2] and mechanical interventions involving whole-body [3] or direct lower-limb [4] vibration enhance the proprioceptive input from the foot and ankle complex.</p> <p>In 2006, SESRC researchers developed a column-based mid-sole design, comprising differing mid-sole densities, intended to mechanically stimulate the wearer and effectively modulate the impact forces during walking. The concept aimed to enhance the activity of the stabilising leg muscles by creating a more active loading profile, pushing the wearer into the middle section of the softer, 'questioning' foot-bed zone earlier than traditional footwear. The new technology was termed "MicrowobbleboardTM".</p> <p>A 2006 study by the SESRC [5], funded by Brandhandling Ltd, evaluated the effects of this new footwear on ground reaction force and muscle activity during walking, compared to standard athletic footwear. The research found significantly increased electromyographic amplitude of the lateral stabilizer m. peroneus longus (12%); prolonged activation time of the pelvis stabilizer m. gluteus maximus (42%), reduced stance time duration and increased rate of force production during propulsion. These findings indicate that the neuromuscular responses are more likely a result of the specific characteristics of the footwear rather than being induced through destabilisation only. The study results were independently verified by research conducted by Drs Graham-Smith and Jones at Salford University.</p> <p>The research findings confirmed the potential of exploring a soles' construction to impact an individual's gait pattern via stimulation of the peripheral sensory system during every step.</p> <p>Since 2008, the SESRC has, with significant funding from FitFlop Ltd, undertaken further research and development of the technology using 3-dimensional motion capture and neurophysiological methodologies. These follow-up studies, based upon the FitFlopTM sandal [6, 7], have: (i) identified</p>

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a 22% increase in shock absorption with interaction, (ii) confirmed the enhanced activation of specific lower limb muscles and reduced plantar pressures under the mid-foot and forefoot regions, (iii) justified clinical implications in light of the significant reduction in sagittal plane ankle joint range of motion and joint moment-related indices.

3. References to the research (indicative maximum of six references)

1. James DC and Cook DP (2011). Coefficient of cross-correlation analysis of kinematics during walking barefoot and in Vibram Five Fingers®. *Footwear Science*; 3:sup1, S79-S81.
2. James DC, Chesters T, Sumners DP, Cook DP, Green DA, Mileva KN. (2012). Wide-Pulse Electrical Stimulation to an Intrinsic Foot Muscle Induces Acute Functional Changes in Forefoot-Rearfoot Coupling Behaviour during Walking. *Int J Sports Med*; 34(5): 438-43.
3. Cook DP, Mileva KN, James DC, Zaidell LN, Goss VG, Bowtell JL. (2011). Triaxial modulation of the acceleration induced in the lower extremity during whole-body vibration training: a pilot study. *J. Strength Cond Res*; 25(2): 298-308.
4. Mileva KN, Naleem AA, Biswas SK, Marwood S, Bowtell JL. (2006). Acute effects of a vibration-like stimulus during knee extension exercise. *Med Sci Sports Exerc.* 38(7):1317-28.
- 5*. Cook DP, James DC, Mileva KN. Efficacy testing of 'Microwobbleboard™' technology. Research report for FitFlop Ltd (2007).
- 6*. James DC, Cook DP. Validation of 'Microwobbleboard™' technology on existing and new product development. Research report for FitFlop Ltd (2009).
- 7*. James DC, Cook DP. Re-investigating the efficacy of 'Microwobbleboard™' technology incorporated within the original FitFlop™ sandal. Research report for FitFlop Ltd (2012).

*LSBU Research report(s) for FitFlop Ltd – available upon request from LSBU

4. Details of the impact (indicative maximum 750 words)

This impact case study demonstrates how research carried out by the SESRC has culminated in the development of a new recognised category of health and wellness footwear, based upon 'Microwobbleboard™' technology, which has directly led to the creation and growth of a successful international business, FitFlop Ltd.

Following a search of UK universities for relevant expertise in foot and ankle biomechanics in 2006, the Founder of Brandhandling Ltd approached the SESRC. Specifically, Brandhandling were interested in the column-based mid-sole concept developed by the SESRC, and commissioned further research and development of the concept into a footwear product. SESRC biomechanists subsequently developed a prototype sandal based upon the 'Microwobbleboard™' technology.

Under the terms of the contract with the SESRC, Brandhandling owned the Intellectual Property and in 2007, they filed a patent application for 'Microwobbleboard™' technology with SESRC researchers as named inventors. The PCT Patent was granted in 2012 [1]. Brandhandling subsequently incorporated the novel technology into its FitFlop™ brand of technology-driven and affordable health and wellness footwear. Based upon the initial market success of the FitFlop™ footwear (Walkstar™ launched in 2007), Brandhandling Ltd. took the business decision to commercialise the technology more widely through a special purpose vehicle, viz. FitFlop Ltd (incorporated 2007).

FitFlop™ footwear proved to be instrumental in establishing a new category of health and wellness footwear, subsequently enlarged by entry of major footwear manufacturers, such as, Reebok and Sketchers. The SESRC has continued to work closely with FitFlop Ltd to further develop Microwobbleboard™ technology and explore its application in further designs of footwear.

Independent Consultants, commissioned by LSBU in 2013 to assess the impact since 2008 of the SESRC's research and contribution to the development of FitFlop™ and FitFlop Ltd, established that the Company has (2):

- grown from a single (Walkstar™ , a female sandal) to a multi-product (sandals, clogs, boots,

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and sneakers for both men and women), multi-national footwear manufacturing and retail brand;

- generated revenues of \$350million from the sale of over 17million pairs of FitFlop™ footwear;
- increased its workforce from 17 (2008) to 160 in 2012;
- expanded its operations into 52 countries with e-commerce websites in the UK, France, Italy, Spain and the USA;
- established an Intellectual Property portfolio based around 3 different footwear technologies and designs;
- received the American Podiatric Medical Association (APMA) Seal of Acceptance (2011) (3);
- won business awards, including the 2012 Avaya Customer Innovation Award (4), and the 2011 Draper Footwear 'footwear brand of the year' Award (5).

The Head of Legal and Business Affairs at FitFlop Ltd has acknowledged the fundamental contribution made by SESRC research to FitFlop Ltd's rapid growth and success (6). She has stated that: *"without the research carried out by LSBU, FitFlop would not have been created"* (2).

Each pair of FitFlop™'s sold around the world contains a label acknowledging LSBU's involvement in the development of the footwear, as does the FitFlop web site (7)

The combination of technology, comfort and style has turned the FitFlop™ into an appealing footwear brand. Wearers consistently comment (7) on the personal benefits and comfort derived from the Microwobbleboard™ technology. As part of its world-wide marketing strategy, the Company coined the slogan *'get a workout while you walk'* which was promoted through television features such as the Oprah Winfrey show (2008).

In addition, the potential for clinical indication has been recognised. For example, a leading consultant orthopaedic surgeon at Royal Surrey Hospital, Guildford has stated (8): *"Patients with painful feet usually select a flimsy soft shoe, not realising that they need the opposite. The combination of support and cushioning, with a degree of built in "rocker", that the FitFlop™ shoes provide is perfect for nearly all my patients. No other commercially available shoe is better. Prescription shoes are almost a thing of the past."*

Since 2011, FitFlop Ltd. has commissioned further contract research with the SESRC valued at over £200k to explore and develop further novel footwear products in order to extend the Company's product range and capitalise on the underpinning science.

5. Sources to corroborate the impact (indicative maximum of 10 references)

1. PCT Number 0708244.9.
2. Report of Independent Consultants (The Innovation Partnership, 2013). Contact: Managing Director, The Innovation Partnership – covers the contribution made by the SESRC to the development of FitFlop™ and the associated success of the FitFlop Ltd.
3. <http://www.apma.org/Learn/company.cfm?ItemNumber=1439>
4. <http://www.avaya.com/uk/about-avaya/newsroom/news-releases/2012/pr-290512/>
5. <http://www.drapersonline.com/news/footwear/news/drapers-footwear-awards-winners-revealed/5025235.article>
6. Contact: Head of Legal and Business Affairs, FitFlop Ltd
7. <http://FitFlop.co.uk>
8. Statement: Consultant Orthopaedic Surgeon, Royal Surrey Hospital, Guildford.