Institution: Aston University

Unit of Assessment: 19 Business and Management Studies

Title of case study: Using systems thinking to improve operations management practice in organisations

1. Summary of the impact (indicative maximum 100 words)

Aston University has developed systems thinking, specifically soft systems thinking, into a new approach known as the Process Orientated Holonic (PrOH) Modelling Methodology which has been used to model, debate and implement changes to strategy and operational processes in service and manufacturing organisations. Through PrOH Modelling our research has changed the awareness, use, and long term legacy effect in a variety of organisations as exemplified here by 4 cases in which considerable operational and financial impacts have accrued. These impacts have been achieved by (i) increasing *awareness* of systems thinking, particularly soft systems thinking, by management (ii) implementing *use* of soft systems thinking (as PrOH modelling) to give demonstrable organisational improvement in specific change projects, and (iii) ensuring a *legacy effect* of systems thinking practice, as managers' use of systems thinking is more effective after an initial Aston University led project has been completed.

2. Underpinning research (indicative maximum 500 words)

Aston University's critical thinking into operations, strategy and management of change has long focused on systems thinking and provides context for the majority of work done in the Operations and Information Management Group (OIMG). Key selected researchers (Table 1) have conducted quantitative and qualitative systems modelling, simulation and change management since the late 1970s.Historically, this was limited to applying standard approaches.

Name	Position(s)	Started	Present
Dr. John Edwards	Prof. → Emeritus Prof. in Knowledge Mgt. & IS	1978	yes
Dr. Duncan Shaw	Snr. Lecturer → Prof. in Operations Research	2001	to 2011
Dr. Ben Clegg	Lecturer → Reader in Operations Mgt.	2003	yes
Dr. Prasanta Dey	Snr. Lecturer → Professor in Operations Mgt.	2004	yes

Table 1: Selected key researcher details – when research was done and by whom

However, **Aston University's OIMG** has now shown that standard soft systems methodologies (SSM) are too vague to be used effectively for organisational process improvement and standard hard systems methodologies (HSMs) are inappropriate for facilitating operations change management projects. This is because the former are too ill-defined and the latter are too mechanistic. PrOH Modelling sits between hard and soft methodologies by defining a set of rules and guidelines that enable holarchies (see **refs 3.1, 3.2** and **3.3**) to be validated and verified. This has been established through applied research to change management initiatives (detailed in Sec.4) driven by factors that include energy use reduction and a weaker economy.

The initial and original scientific research findings relate specifically to the PrOH Modelling Methodology and the composition of holarchies in organisations. The PrOH Modelling Methodology is an extension of SSM but differs from it as PrOH Modelling has radically new and different rules and guidelines used to build sets of process models into holarchies (where each part – a holon – is both a whole process and part of another whole process) rather than into hierarchies (where each part is part of a whole with explicit inheritances from the whole). In brief this is because PrOH modelling builds *holarchies* of models composed using rules of *abstraction and enrichment*, rather than using HSM rules which build organisational models as *hierarchies* using rules of *aggregation and reductionism* (see **refs 3.1, 3.2** and **3.3**) or pure SSM that has no explicit rules or guidelines to build sets of *process* models. Thus PrOH Modelling can produce holarchies which allows re-contextualization of elements in holons at different levels of the holarchy to exhibit emergent and hidden properties.

In layman's terms this means that a set of systems models can be built using PrOH Modelling to

represent a human activity (e.g. a business process) without having to resort to mechanistic similes. In addition systems thinking presentational techniques (e.g. story boarding - combining words and pictures effectively - and the use of scene setting) have been perfected in PrOH Modelling to make it appealing and accessible to non-expert practising managers. This is significant because PrOH Modelling assumes that systems composed of people, culture and awkwardly codified processes cannot be optimised in ways suited to mechanical systems, but must be improved through consensus building. These contributions to systems science were made at Aston University from 2003 to 2007.

Further original underpinning research is continuing to make contributions to systems science by applying quantitative performance measures into holarchies (see **refs 3.4, 3.5** and **3.6**). The nature of this research allows it to be published in top journals in the systems science field, in addition it can be used in practical consultancy projects (**refs I, II, III**), debated in funded academic fora (**ref IV**) and used in research capacity building grants (**ref V**), CASE awards (**ref VI**) and Knowledge Transfer Partnerships awards (**ref VII**).

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

Publication References (selected [citations given as per Google Scholar 23.7.13]

3.1 Clegg BT, 'Business Process Orientated Holonic (PrOH) Modelling'. Business Process Management Journal. Vol12, No4, 2006, p410-432, DOI: 10.1108/14637150610678050 - Gives rules of holarchy building. [19].

3.2 Clegg BT, 'Building a Holarchy using Business Process Orientated Holonic (PrOH) Modeling'. IEEE Systems, Man and Cybernetics: Part A. Vol.37, No.1, Jan 2007, p23-40, DOI: 10.1109/TSMCA.2006.886343 - Gives detailed rules of holarchy with a manufacturing example. [7]

3.3 Clegg BT, Shaw D 'Using Process-Orientated Holonic (PrOH) Modelling to Increase Understanding of Information Systems'. Information Systems Journal. Vol18, 2008, 447-477, DOI 10.1111/j.1365-2575.2008.00308.x - Gives detailed rules of holarchy building with an information systems example. [9]

3.4 Clegg BT, Orme, R 'A Systems Approach to Developing a Unified Methodology and Deployment Model to Help Maximize the Impact of Lean Thinking and Six Sigma in Organizations' British Academy of Management Conf. Birmingham. 13-15 Sept. 2011. Applies PrOH Modelling to Lean Six Sigma training with quantitative metrics for cost of quality.

3.5 Clegg BT, Orme R 'Systems of Systems: Pure and Applied to Lean Six Sigma, in 'System of Systems', ISBN 979-953-307-110-6. Ed. A.V. Gheorghe. InTech, Rijeka, Croatia. Hardback. March 2012. p57-76. 2524 downloads, July. '13 (mostly from USA) as verifiable with the publisher website. Discusses the divide between HSMs and SSMs.

3.6 Clegg BT, Orme R 'A Systems Approach to unifying Lean Thinking and Six Sigma to improve the Impact in Organizations'. World Conference: European Operations Management Association (EurOMA), North American & Japanese Operations Management Associations. 1-5th July 2012, Amsterdam. Discusses systems thinking for change management.

Copies of all publications are available upon request.

Grants (selected as directly relevant to the underpinning scientific research)

I. **Industry funded project with SigmaPro, Birmingham. '**Improving quality management syllabi'. Using systems thinking to survey, analyse and review current syllabus. New training syllabus adopted as a result of this work. Clegg. £5,580. Jan'06-Nov'06**.**

II. **Innovation Voucher (EPSRC, ESRC & Advantage West Midlands funded) with Pinstripe Ltd '**Improving customer interface practice using systems thinking'**.** A small printers. Publicised on Govt. News Network. 28.1.2008 and HeartFM. Process improvements implemented. Clegg, Shaw, Scully. £3k Nov'07-Jan'08.

III. **DTI Manufacturing Advisory Service (West Midlands) with Brintons Carpets,** 'Audit of a quality management and supply chain system using systems thinking'. Quality procedures and processes changed at company. Clegg & Dey £20,150. Mar'08-Sep'08**.**

IV. **ESRC Seminars Competition** 'Trends in Modern Operations Management' Ref. RES-451-26-054. 5 seminars delivered on best practices for operations, 260 attendees, see www1.aston.ac.uk/aston-business-school/research/groups/oim/research/esrcseminars/) Clegg & Dey. £18,159. Sept'08-Jun'10**.**

V. **ESRC Capacity Building Cluster** 'Engaging Research for Business Transformation' 'EREBUS'. Clegg, Edwards & Scully Ref. RES-187-24-0005. Held in collaboration with University of Warwick and University of Birmingham. Aston is Lead institution. Won on Aston's reputation for applied business research, systems thinking and change management. £2,128,343. September 2008 - August 2013

VI. **ESRC Case Award with SigmaPro.** 'A systems Approach to integrating lean thinking and six-sigma'. £72,569 (plus £46,000 in-kind training in 6-Sigma). Clegg. January 2011 – December 2013.

VII. **Knowledge Transfer Partnership (AWM & ERDF funded) with Higgs & Sons.** 'To implement an innovative cultural change programme that will impact on sector performance by better understanding client needs, re-examining pricing strategy and challenging operational processes' Used PrOH Modelling for change. Clegg. £121,656. August 2011 – July 2013.

The originality and rigour of our research may be gauged by the peer-reviewed publications and high quality journals in this section and its significance by the grants awarded totalling £2.2M.

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

The initial original research at Aston University established a reputation for PrOH Modelling. We now present evidence that this PrOH Modelling research, as cited in Sec.2 and Sec.3, has changed the awareness, use and legacy effect in a variety of companies, as exemplified here by 4 cases in which considerable operational and financial impacts have been accrued.

Higgs & Sons Solicitors, Brierley Hill, (August 2011 – July 2013) chose 5 different legal services to be improved through PrOH Modelling. The following quotes are taken from corroborating Letter **ref 5.1** (i) Road Traffic Accidents: "conversion rates were increased significantly from 67% to 93% ... this and other changes will have a calculated annual impact of just under £200k profit". (ii) Dispute Resolution: a PrOH Modelling exercise revealed better case management tools were required" and "transparency in pricing also impacts on client satisfaction…" giving, "… a calculated annual impact of just over £400k" (iii) Commercial Property services "…developed a targeted approach to acquisition of new significant clients … effectiveness increased by 8% equivalent to £150k annualised profit …". The final two services are still in progress [at date of letter], but (iv) "The Corporate Services team responded very positively to the PrOH Modelling approach readily identifying training requirements", also "…the fast track production of sales-pitch documentation is alone expected to save a significant amount of time and money." (v) Private Client: services revealed more efficient ways of managing wills and probate services as, "a significant project to document, scan and manage all of the information in the will bank has been reinvigorated …" Overall it is estimated that £750K annualised savings have been generated and, "Without the use of PrOH modelling it is very unlikely that these changes would have happened…". This work also generated 12 articles in non-academic publications (2 from the law sector, 2 from professional management practice and 8 from the free press (see citations selected in **refs 5.5-5.9**). In July 2013 on the basis of this work Higgs & Sons have been recognised nationally by the law sector and nominated for a national award for innovation by The Lawyer (**see ref 5.10**); and subsequently won 3rd place.

SigmaPro, Solihull (January 2008 – July 2013) is a small international management training company. SigmaPro used the ideas of general systems thinking from our research to build a survey that examined the cause and effect of different quality management techniques. As quoted from corroborating Letter **ref 5.2** "The effect of this was to make our training credible in today's market. We estimate the effect of this was to increase sales by at least 10%, and increase student satisfaction rates which led to higher repeat business. All this has helped SigmaPro to expand". As a result of this initial work further ESRC support was won (by Clegg) in the form of a CASE award (January 2011 onwards) to support SigmaPro to develop a unique model using PrOH modelling and systems dynamics; "Although it is still early days to boast about the impact of this CASE Award, it has led to a prototype hybrid soft-hard 'cost of quality' model being built which can assess the maturity of an organisation, predict its cost of quality, diagnose areas of deficiency and thus direct consultants to more accurately prescribe suitable actions". This tool has been used

successfully with clients (in early 2013) and has helped SigmaPro create a unique selling point. "This new tool, based on the PrOH Modelling Methodology, will help us market our services and give us advantage over our competitors" (**ref 5.2**).

Pinstripe Printers, Birmingham (January 2008 onwards). PrOH Modelling was used to review the customer interface process for design-and-print-contracts. The following gains were achieved by using PrOH Modelling. Quotes from corroborating Letter **ref 5.3** show that after PrOH modelling (i) "it was easier for technical staff to capture customer requirements…10% improvement over 3 months and on-going" (ii) "Increased emphasis was placed at providing extra services to customers, so they were more satisfied with the job…" (iii) it "Improved the scheduling of jobs – 10% improvement over 3 months and on-going" (iv) it helped the "generation of a continuous improvement culture in the business". Overall, "…without the use of PrOH Modelling it was unlikely that these changes would have occurred because PrOH modelling was particularly well suited to managing change…"

Brintons Carpets, Kidderminster (March 2008 – September 2008 initially continuing up to 2013). The quality management and supply chain management practices used to deliver client projects were reviewed using systems thinking and PrOH modelling. PrOH modelling was used in focus groups with the senior management team to rethink operations strategy. As in Letter **ref 5.4** "The immediate improvements made as a result of the work can be summarised as follows (i) productivity improvements, as loom rectification hours and rework was reduced by 18% (ii) scrap and defects were significantly reduced, with external failure rates reduced by 57% (iii) on-time delivery improved by 14% (iv) general improvements were made to the Brintons Operating System (BOS) and a cultural change caused a shift from reactive quality recovery to proactive quality [failure] prevention. The medium term effects of this work contributed towards the standardisation of practices between the UK factories and the new factories in India and China; and subsequently in the long term towards new investment in the company from foreign investors [from the USA] which has reinvigorated its future. Without this intervention the outcome of the company may have been very different".

In summary, all of these cases have improved the awareness, use and legacy effect of systems thinking in their organisations to improve operations management practise. These cases show breadth of applicability as PrOH modelling has been applied to a large leading international manufacturer (of carpets), a small product-service provider (printers), a medium-sized professional service company (solicitors) and a small international (management) training company from the private sector. **In each case the depth and significance of impact** is supported by a letter of corroboration (**refs 5.1 – 5.4**).

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

Official letters of corroboration commending PrOH Modelling research and application

5.1 Higgs & Sons Solicitors, the Finance Director and the Managing Partner, 3rd May 2013.
5.2 SigmaPro, Director of Operations, 2nd May2013
5.3 Pinstripe Printers, Managing Director, 8th May 2013
5.4 Brintons Carpets, Manufacturing Director, 17th May 2013.

Selected non-academic references commending PrOH Modelling research and application

5.5 'The Laws of Lean' The Lean Management Journal. p21-22. May 2013. For managers.
5.6 'Fear and growing in the downturn' Solicitor's Journal, 23rd April 2013. For lawyers.
5.7 'Unique Boutiques'. The Lawyer. UK200 Annual Report. KTP project and PI named, quoted and featured. p24-26.Oct. 2012.For lawyers.
5.8 'Firm faces "Tesco Law" Head on'. Birmingham Post, Business Section. 26.7.2012. p14.
5.9 'Higgs and Aston University join Forces to find Optimum Process for Legal Services'. Midlands Business News. 19th July 2012. For business leaders.
5.10 National award shortlisting for 'innovative management' by The Lawyer in July 2013 (3rd place was awarded on 24.9.2013 at a national ceremony attended by 1000+ people held in the Barbican, London).