

Delay and disruption disputes

A successful approach since 1976

System Dynamics was invented by Prof. Jay Forrester at MIT's Sloan School of Management in the late 1950s, and it was initially applied to the study of global macroeconomic and social development forces. In 1976, Ken Cooper and his team at the consultancy Pugh Roberts Associates were the first to use System Dynamics to analyse disruption and delay on a complex project.¹

Pugh Roberts used System Dynamics to prove how the U.S. Navy had delayed Ingalls (an American shipyard then owned by Litton Industries) in the design and construction of a new class of warship. This assessment was instrumental in securing a very favourable settlement for Ingalls/Litton (see Figure 1), and this success paved the way for the further application of System Dynamics for the assessment of delay and disruption on complex construction and engineering projects.

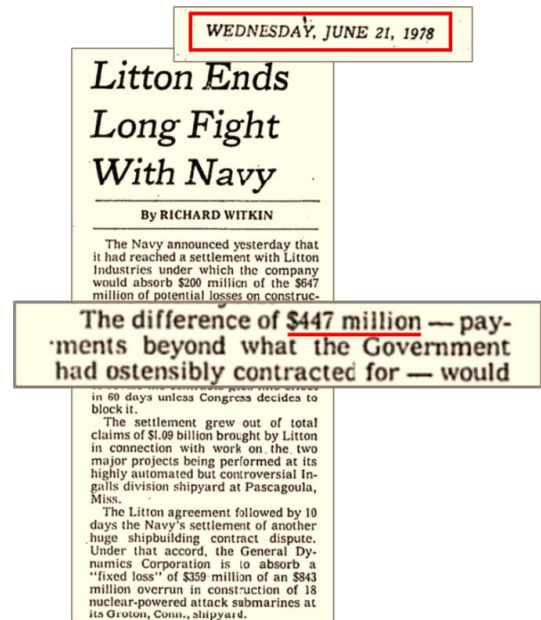


Figure 1: A new method is born, as reported by The New York Times.

Track record in disruption and delay claims

System Dynamics has been used to produce expert evidence in support of over fifty major disruption and delay disputes, with claim values ranging from \$10-20 million to over \$5bn. The projects involved include airports, nuclear power plants, marine vessels of all sorts, new aircraft types, chemical plants, oil & gas infrastructure... and even world-renowned engineering accomplishments like the "Channel Tunnel". Figure 2 shows press headlines for a subset of these projects in which CDS consultants were involved (in different capacities.)



Figure 2: Sample of disputes where System Dynamics has been used to provide expert evidence.

¹ See Cooper, Kenneth G., "Naval ship production: A claim settled, and a framework built", INTERFACES Vol. 10, No. 6 December 1980, The Institute for Management Sciences.

Dynamic Disruption and Delay Analysis (D3A)

Confidentiality clauses prevent us from disclosing any information relating to any of these cases, with the exception of the Golden Pyramids Plaza arbitral award (recently published online.) The award shows how an international tribunal of highly qualified arbitrators found the SD analysis persuasive enough for them to unanimously award the full amount of the disruption and delay impacts claimed by the contractor (Figure 3.)

• Conclusion

The Tribunal concludes that Respondent has been unsuccessful in discrediting the method applied by [REDACTED] and their conclusions. The Tribunal finds that the [REDACTED] System Dynamics analysis, as confirmed by Professor [REDACTED], is appropriate and that its findings are reasoned and supported by evidence.

Figure 3: Redacted excerpt from the Golden Pyramids Plaza arbitration award (underlining added.)

As a final example, in 2019 Lexology published the outcome of an arbitration in the US. In this case, the admissibility as expert evidence of the System Dynamics analysis was challenged (unsuccessfully), and the tribunal ended up awarding 70% of the disruption damages claimed.

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In the private arbitration case mentioned above, the case did not settle and went to full trial. As a result, the arbitrator rejected the owner's *Daubert* challenge and, instead, found that the system **dynamics** expert and the **modeling** contained in the expert report and testimony "provided a reliable indication of the **disruption** damages." An award of over \$13M was granted to the contractor for **disruption** part of the overall claim, which was over 70% of the amount claimed through the system **dynamics** analysis for disruption.

Figure 4: News of a recent arbitration award in the US (2019.)

The Society of Construction Law

In 2017, the Society of Construction Law issued the 2nd Edition of its "Delay and Disruption Protocol", a document that is used in many regions of the world as THE standard reference for delay and disruption assessments.

The Protocol includes a classification of the various types of methods that can be used to assess disruption, and its 2nd Edition now includes System Dynamics in this list. More specifically, System Dynamics is included within the subcategory of productivity-based methods/project-specific studies, the preferred type of disruption assessment method

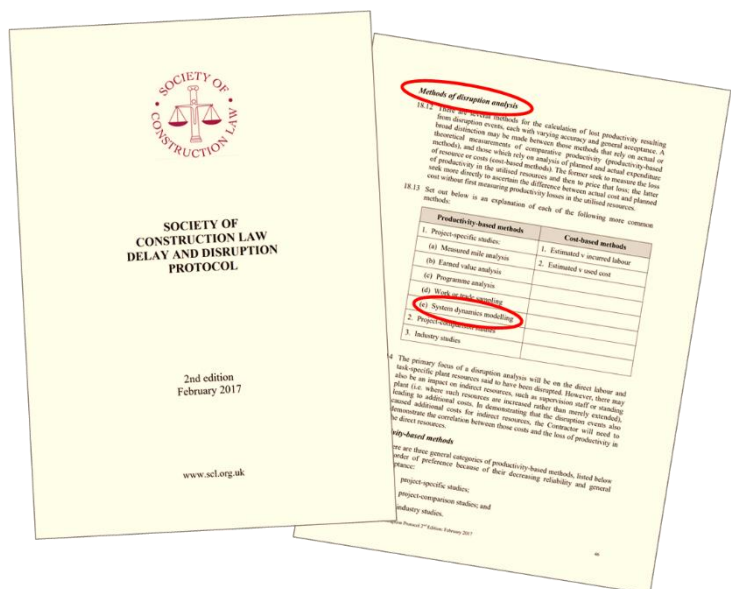


Figure 5: The SCL Protocol recognises System Dynamics.

Furthermore, in 2017 Ralph Goodchild's essay "Proven by Computer? System Dynamics and Disruption Claims" won second prize in the SCL's annual Hudson essay competition.

Project Management

Track record in proactive project management

Over the last five decades, hundreds of major projects have used System Dynamics to optimise project plans and to minimise disruption and delay risk: examples range from single project assessments to full-blown project portfolio risk reduction systems, mostly in the engineering, aerospace and automotive industries.

Confidentiality restrictions in this field have been as stringent as those applied to dispute work, so there is little public information about it – although a few exceptions also exist here.

One application of System Dynamics that has become public knowledge is the Change Impact Assessment ('CIA') tool developed by the Fluor Corporation in 2006.

Based on a System Dynamics simulation model, this tool allowed Fluor to more accurately estimate the ripple effects that any proposed changes would cause on any of their projects worldwide, and to identify strategies to minimise these.

As a result of the use of this tool, Fluor publicly claims to have saved over \$840 million in the period 2006-2011.

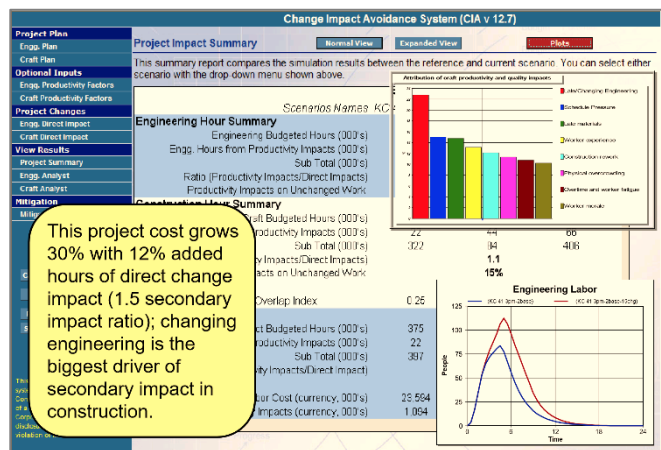


Figure 6: Fluor's 'CIA' tool.

System Dynamics has also repeatedly been applied to reduce risk on military projects (aircraft, naval vessels, IT infrastructure), on assessments commissioned by contractors and by government agencies both in the US and in the UK. For example, in 2010 the Naval Engineers Journal published how System Dynamics had been used by the US Navy to achieve targeted total \$12.4bn design and production cost savings on the Virginia Class submarines.

Industry recognition

Professional organisations

Beyond the recognition given to System Dynamics as a retrospective assessment method to be used in claims, many professional construction and engineering organisations have published articles describing how System Dynamics can help to manage projects better. Of these, the most notable are probably the Project Management Institute ('PMI') and the American Society of Civil Engineers ('ASCE'): A search of their websites identified over 200 articles and conference papers referring to System Dynamics.

Other key milestones regarding the recognition of System Dynamics by the construction and engineering industries have been the following:

Dynamic Disruption and Delay Analysis (D3A)

- In 2004, the “Wiley Guide to Managing Projects” (edited by Peter W. G. Morris and Jeffery K. Pinto) included a full chapter based on the insights learned through the use of System Dynamics: Chapter 31, “Project Changes: Sources, Impacts, Mitigation, Pricing, Litigation and Excellence”, written by Kenneth G. Cooper and Kimberly Sklar Reichelt.
- In 2009, the Engineering Construction Risk Institute (‘ECRI’) designated System Dynamics as “industry best practice” for managing the secondary (ripple) impacts of changes.
- In 2011, the Fluor Corporation became a finalist in the Franz Edelman Award competition, presented by the Institute for Operations Research and the Management Sciences (‘INFORMS’), for its work on the CIA system.
- In 2020, ASCE awarded its prestigious Thomas Fitch Rowland prize to Ibrahim S. Abotaleb and Islam H. El-adaway, for a paper based on System Dynamics that has now been designated ‘Best Practice’ by the Construction Industry Institute.²

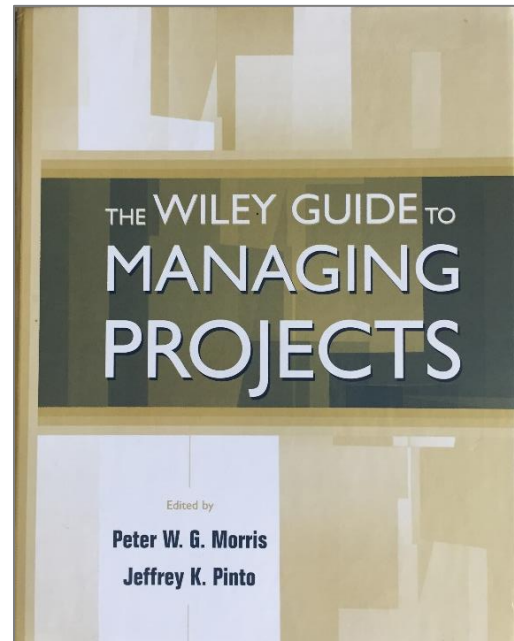


Figure 7: The Wiley Guide to Managing Projects.

Wider recognition of System Dynamics

Beyond the construction and engineering industries, System Dynamics is universally accepted as a reputable discipline in the social sciences.

- The System Dynamics Society was formed in 1983, and as of 2017 there were more than 10,000 members from over seventy countries.
- Since 1985, the System Dynamics Review has served as the primary refereed journal for publication of research and applications. Papers based on System Dynamics are also regularly published in many of the top journals in the social sciences, like the European Journal of Operations Research, Interfaces, Journal of Economic Behaviour and Organisation, etc.
- System Dynamics is an established subject of academic study, and as such it is taught at a multitude of universities around the world.
- Many of the world’s leading consulting firms have also used System Dynamics; these include (among others) Bain, Booz Allen Hamilton, Boston Consulting Group, McKinsey & Co., Accenture, AT Kearney, and PriceWaterhouseCoopers.

² Construction Industry Institute (CII), (2021), “Best Practices for Preventing Out-of-sequence Construction Activities and Minimizing their Impacts – RT-334”.

Construction Dynamics Solutions

While our consultants have decades of experience in the field, Construction Dynamics Solutions was only created recently, in 2018. However, since its inception the company has already supported six major disputes in the MENA region, with a combined claim value close to \$2bn. The projects involved are two new airport terminals, a solar plant, a refinery subcontract, a hotel complex and a road infrastructure project.

Of these, only the refinery subcontract dispute has been fully resolved to date – in fact, both parties were able to reach an agreement within three weeks of our involvement. In the words of our client, “System Dynamics was instrumental to the successful settlement of our claim”.

More recently, CDS has also been engaged to help automate the set-up and calibration of System Dynamics tools to be used to assess cost and delay risk on naval projects.

Finally, CDS consultants routinely deliver lectures, webinars, workshops and presentations on the use of System Dynamics in disruption and delay claims, in events organised (among others) by the Association for the Advancement of Cost Engineering (‘AACE International’), the Royal Institute of Chartered Surveyors (‘RICS’), the European Society of Construction Law (‘ESCL’), and the European International Contractors association (‘EIC’) and the Institution of Civil Engineers (‘ICE’).



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www.constructiondynamics.global/on-disruption-and-delay

