

Waste No More

Reducing Turnaround Time (TAT) – an essential ingredient to improving patient care for the modern laboratory

Living up to Life



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Abstract

Lean practice has made a significant impact to the clinical diagnostic and life science laboratories. Enhancements, both technological and methodical, have reduced process times from days to hours while improving service quality. Histology is one discipline where Lean principles are having a large impact by streamlining inefficient batch-based processes.

With cases requiring immunohistochemistry (IHC) tests growing at a rate of 10% on average per annum and increases in demand on routine histology resources and a downward pressure on costs, laboratories worldwide are looking to Lean as a realistic solution toward meeting future demands. By adopting a Lean program, laboratories are able to improve efficiency, reduce staff pressures, cut Turnaround Time (TAT) for IHC¹ and, most importantly, deliver better patient care.

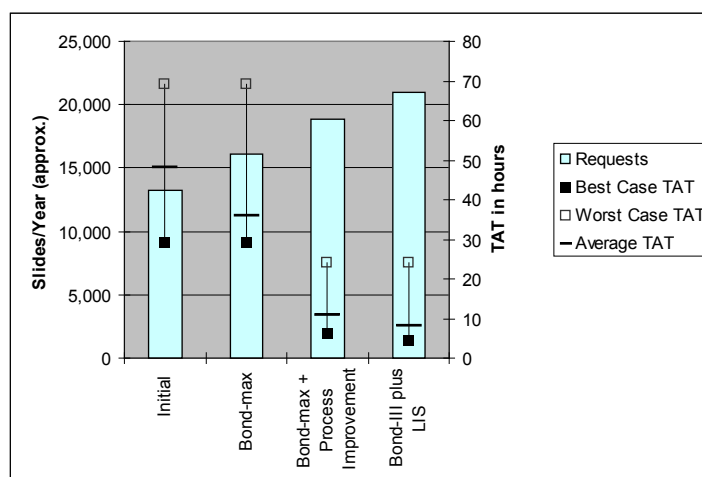
Case Study – Path Links Histopathology, Looking to Improve

The Path Links² Pathology service, in the United Kingdom, is a single managed Clinical Pathology Network operating across Lincolnshire. It serves an increasing population of over one million people. As part of a Pathology Modernisation project, staff at Path Links initially sought Lean expertise³ in an effort to optimise their work processes, reduce TAT, and eliminate errors. Specifically, an early review focused on redesigning in-house processes to create extra capacity to deal with anticipated workload increases in the coming years. This initial approach culminated in Path Links adopting a comprehensive long term Lean program to achieve desired improvements.

This case study specifically looks at improvements made to the Further Workcell area, a Lean work cell that processes all special stain and immunohistochemistry requests. Through three generations of automation and several cycles of process improvement, Path Links has slashed its Best Case TAT from 29 hours to just 4.5 hours, an 85% improvement. The study examines the role played by the fully automated Bond IHC system from Leica Microsystems, and also examines why automation alone is not the answer to Lean productivity and improved patient care.

The data in the graph (right) quantitatively demonstrates the TAT reduction Path Links has achieved as an overall result due to

the changes implemented since 2005. This is despite having the same number of staff and an increase in requests. Also, reduced TAT is not the only advantage. Lean principles coupled with Bond automation (especially the latest Bond III system) have also produced many other benefits that include reducing errors and releasing staff time for other high-value work.



1. The time between pathologist request and issuing the slide including block retrieval, section cutting, and drying as well as post staining procedures and Quality Control checking.
2. Path Links provide pathology services for hospitals in Lincoln, Boston, Grantham, Grimsby and Scunthorpe. Path Links is managed by Northern Lincolnshire and Goole Hospitals NHS Foundation Trust (NLaG).
3. Argent Global Services provides process engineering, training, consulting, and software development solutions that have assisted hundreds of companies to achieve competitive advantages in the global marketplace. Argent is recognized as a leader in implementing solutions that increase productivity, improve quality, and enhance service levels for clients across many industries.

Limited Automation

Path Links recognized in 2005 that its existing immunostainers would not be sufficient for future plans, particularly as trends demonstrated that the IHC slide requests were significantly increasing. A key objective for a Lean laboratory is the achievement of “single piece flow” whereby samples entering the laboratory are processed as they arrive without delay. Where this is not possible or impractical the aim is to achieve a smooth flow by keeping batch sizes to an absolute minimum and eliminating bottlenecks. The existing platforms would not enable a Lean workflow as they:

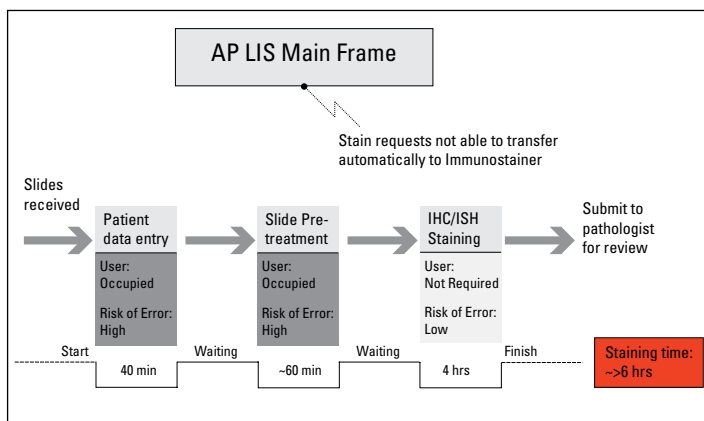
- prevented overall flow
- were not continuous access
- prohibited batch size reduction

Some key limitations were:

- IHC slide requests entered into the AP LIS were required to be entered again at the PC dedicated to the immunostainer. Transcribing errors were possible.
- Pretreatment was not handled by the immunostainer. Slides were pre-treated manually and then loaded onto the immunostainer, which created unwanted batching.
- Manual pretreatment can inherently produce variable results due to inter-user variability.

The Value Stream Map (A – Initial State) for this configuration is shown below.

This system delivered the following results for the IHC process:



A - Initial State VSM (3 Process Steps, Staining Time 6 hours or greater)

- Staining time (from data entered into staining system to stained slide)
 - Data entry = 40 minutes
 - Retrieval/pre-treatment = 1 hour (approx.)
 - Instrument time = 4 hours
 - Waiting time = 2 periods
 - Total: over 6 hours
- 1 run per day plus potential for overnight run
- Best Case TAT = 29 hours
- Worst Case TAT= 69 hours

After the Argent review in September 2005 Path Links recognized that more sophisticated automation was required in order to successfully transition into a Lean workflow. The chosen platform had to offer true automation, incorporate retrieval, and encourage work flow.

First Generation Improvement – Leica Bond-max

Prior to the acquisition of Bond, a number of wastes were identified in the existing process. Workflow analysis highlighted these, and it was evident that Path Links had inadvertently developed inefficient processes, partially due to the limitations of its existing equipment. As a first step to improving its process, Path Links replaced its existing stainers with the fully automated Leica Bond-max IHC/ISH stainer.

Fraser Sim, Cellular Pathology Directorate Manager, explains why the Bond system was chosen: “Our previous platform forced large batching of slides inhibiting flow, and retrieval had to take place off board so standardization of results was also a concern. With Bond-max we sensed an opportunity to immediately address these key issues.”

The Leica Bond-max brought several key benefits to the Further Workcell area, namely:

- Faster finishing times – allowed Pathologists to receive requested slides sooner.
- Total automation of all IHC requests – this included slide baking, pre-treatment, and staining.
- Flexibility – three independent slide staining assemblies allowed better flow of work

Despite this, whilst the introduction of the Bond system sped up processing, introduced increased flexibility, and reduced hands-on time, data collected by Path Links showed that overall TAT was not altered:

- Staining time (from data entered into staining system to stained slide)
 - Data entry = 40 minutes
 - Instrument time = 3.5 hours
 - Waiting time = 1 period
 - Total: 4.5 hours
- 1 run per day plus overnight run
- Best Case TAT = 29 hours
- Worst Case TAT = 69 hours

Robert Hughes, Histology Manager, Path Links, explains:

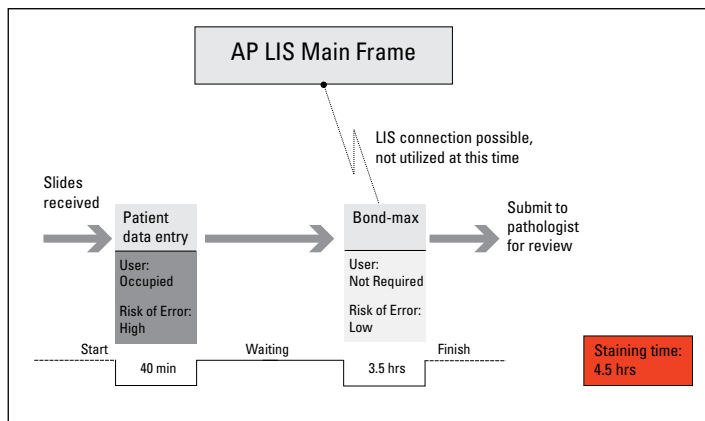
“In effect we automated a bad process. There are improvements between the platforms, with respect to true automation and ability to create flow. However, any improvements to TAT/efficiency were not immediate. The reason being that we initially only upgraded our platform within the same inefficient process. The real gains were achieved when we started looking at our whole further request process and started to eliminate non-value adding steps and improve data transfer.”

Second Generation Improvement – Leica Bond-max plus process improvements

The introduction of Bond-max, while not yielding immediate TAT improvements, made it evident that the benefits of continuous flow presented an opportunity to revamp processes – to not just adapt to the equipment but to get the most from newly available automation and flexibility.

It's important to recognize that new, sophisticated equipment does not necessarily improve a process or service alone. Since 2005, Path Links has undergone a Lean re-engineering process, carrying out numerous Kaizen events. Following the Bond-max installation, Path Links consulted with Leica Microsystems Product Specialists, and process improvements were implemented that realized the potential that full-automation and continuous processing offer.

The Value Stream Map for the processes utilizing Bond-max (B – Second Generation Improvement) is shown below :



B – Second Generation Improvement [2 Process Steps, Staining Time 4.5 hours]

The performance figures measured by Path Links show that while staining times remained unchanged, the process improvements that Bond made possible had a significant impact on overall TAT:

- Staining time (from data entered into staining system to stained slide)
 - Data entry = 40 minutes
 - Instrument time = 3.5 hours
 - Waiting time = 1 period
 - Total: 4.5 hours
- 1 run per day plus overnight run
- Best Case TAT = 6 hours
- Worst Case TAT = 24 hours

The Future State – Exploring the possibilities with Bond III plus Bond LIS-ip

By mid-2009 with the Leica Bond-max integral to the Further Workcell process, Path Links was approached to trial Leica Microsystems' latest offering: the new Bond-III IHC/ISH stainer.

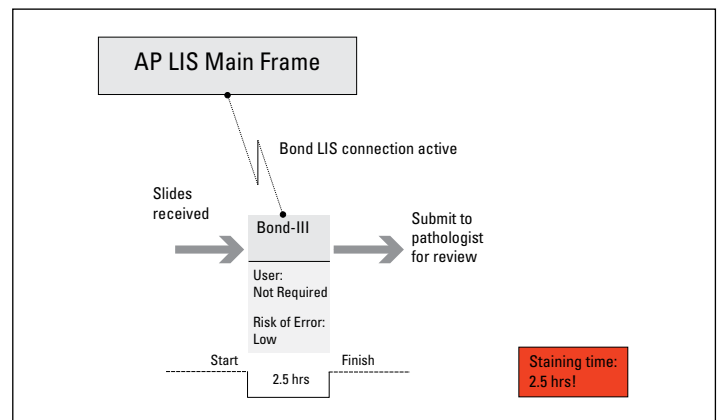
Johnathon Deniz (Automation Product Manager, Leica Microsystems UK):

“Having recognised how entrenched Path Links was in Lean principles and being an existing Bond user, it made perfect sense to see if Bond III would deliver better Turnaround Times from one of our most demanding customers. What really excited me was that any shortcomings of the platform would be clearly identified as Lincoln were already in the process of mapping its daily workflow throughout the entire Histopathology process.”

The immediate improvement that Bond III offered Path Links was that it is 50% faster than previous generation stainers. This speed had an immediate impact on TAT and throughput, reducing an already impressive 6 hour Best Case TAT to just 4.5 hours.

At the same time as Bond III was introduced, Leica Microsystems staff also assisted Path Links to establish a link between its LIS and the Bond III using the Bond-LIS-ip interface. This link allowed a significant process improvement by eliminating double data entry. Case information was now fed directly into the Bond system, which could then directly interpret the LIS labels to eliminate slide re-labeling. Robert Hughes praised the Leica Microsystems LIS integration team for their “willingness to collaborate and successfully manage the LIS connection.”

The Value Stream Map (C – Future State), shown below, clearly illustrates the benefits of the extra speed and LIS connection:



C - Future State VSM [1 Process Step, Staining Time 2.5 hours].

The immediate effect of rapid IHC staining plus the introduction of the Bond-LIS link improved Path Links, already impressive productivity:

- Staining time (from data entered into staining system to stained slide)
 - Data entry = 0
 - Instrument time = 2.5 hours
 - Waiting time = 0
 - Total: 2.5 hours
- 2 runs per day plus overnight run
- Best Case TAT = 4.5 hours
- Worst Case TAT = 24 hours

The gains in TAT made using the Bond III were further amplified due to end-to-end process improvements made after carrying out multiple Kaizen events. Also, TAT reduction is only part of the overall improvement that Bond III made to the Further Workcell productivity. By introducing Bond III and connecting it to its LIS, Path Links immediately saw significant efficiency boosts in many areas. Path Links' staff explain:

Reduced setup and maintenance

Users have stated that access to bulk reagents is improved and the extra capacity in the bulk bottles means less time is spent at the instrument. In fact, Hannah Dury, a Senior Biomedical Scientist (BMS) at Path Links, best summarized this saying "You can load the instrument up at the start of the week and not worry about reagent levels all week. If top-ups are required it's all clearly communicated via the user interface and you don't even have to remove the bulk bottles which used to lead to unnecessary delays".

Improved staff utilization

William Davies, Specialist BMS, Path Links, asserts: "Bond III coupled with LIS connectivity has really made things fly. The quicker run times and reduced operator input has allowed us to increase our throughput with no extra effort at all. Not only has this reduced our turnaround times, which is ultimately good for patients, it has freed time allowing me to support colleagues and further develop my skills as a BMS."



Robert Hughes, Histology Manager, Path Links with Johnathon Deniz, Automation Product Manager, Leica Microsystems UK.

Error reduction

Hannah Drury, spoke highly of the LIS connection stating, "The removal of manual data entry means there's a reduction in error potential and we also don't have to re-label our slides at the end of the process. Now we're using that time to train and improve the immunohistochemistry knowledge of the BMS staff who work in the Further Workcell. Robert Hughes adds, "Many forget that Lean is just as much about quality and error reduction, and the introduction of the LIS connection in my opinion has been the ultimate in error reduction."

Increased capacity

According to Robert Hughes, "There is now the potential that our capacity can increase by a third thanks to the introduction of Bond III. This not only improves TAT potential but also flow."

Conclusion

Using Lean principles, Path Links' capable, knowledgeable staff have cultivated a continuous improvement mindset. They have reviewed existing processes and made astute instrument purchasing decisions, and their success has been noted by laboratories far and wide.

Path Links' staff are happy to open their doors to others looking to implement Lean practices, and they always encourage others to appreciate that the transition is not an overnight process. The journey for Path Links to reduce its turnaround times has been long and challenging, but there is sense among all involved that great progress has been made, but that the process hasn't ended. As stated by Mick Chomyn, Path Links Assistant General Manager, "We recognize that Lean is a continuous improvement process and the work that we have carried out over the last 5 years has created the culture required to continue on this journey. Although we are pleased with the improvements achieved so far, we continue to look for further gains we can make to our process."

By working together, Leica Microsystems and Path Links have demonstrated that the combination of smart automation and careful process planning can deliver what really matters – ongoing improvements to productivity, quality, and ultimately better patient care.

