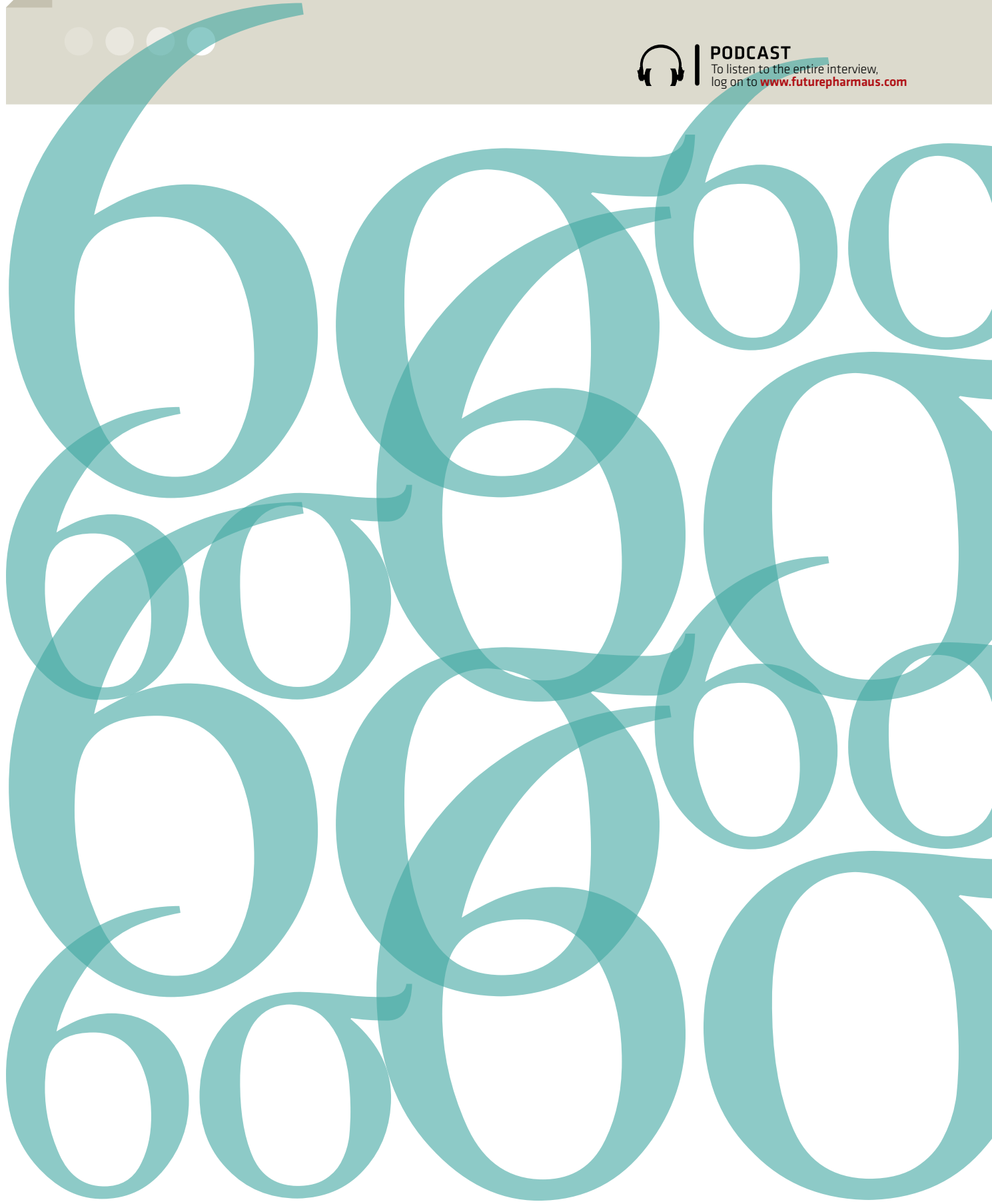




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It's all Greek to Pharma

Lean Six Sigma is a business management strategy that, while getting its start in the manufacturing industry, is making its way to pharmaceuticals and biotechnology. *Read on for insight from the pros of Six Sigma.*

Mike Pestorius Research and development (R&D) is a large cost component for pharmaceutical companies.

Have Lean Six Sigma (Lean) or Six Sigma methodologies been useful in driving efficiencies in that area?

Mike Potosky Absolutely. Perhaps the biggest opportunity in the R&D area is in the Design for Six Sigma (DFSS) space or Six Sigma for product development. Here is where the Six Sigma methodologies can help pull in the voice of the customer — understanding their needs and requirements, convert those into technical requirements for engineers, and design a robust product that has built-in quality and capabilities. This helps us veer away from the build-test-fix process and quality is designed in from the start. At Motorola, this is where we've seen Six Sigma be a major help for us in R&D, and it is beginning to gain interest in our public Six Sigma University as well.

Mark Kiemele We've worked with six different pharmaceutical companies over the last decade, and Lean and Six Sigma methodologies have been extremely useful. We've seen them being used in drug discovery, using high-throughput technology, optimizing reagents, and designing assays; the opportunity is great. In essence, yes, these tools and methods of Lean and Six Sigma have been used, but I don't think we've scratched the surface in the available opportunities in the R&D areas in the pharmaceutical companies.

Consider the following fact: the concept-to-commercialization value stream takes 15 years or more on average and it costs \$880 million to take a product to market. Couple this with the fact that 90 percent of these fail somewhere along the cycle and it becomes apparent that the opportunity is great. Even though we've seen some successes, my feeling is that there's still a long way to go.

MPestorius Let me add on to that idea. A decent sized pharmaceutical product brings in \$250 to \$300 million per year. If you think that you have approximately 250 to 300 selling days in a year, that's about \$1 million for every day

that the product is on the market. So if you can reduce that research and development by even five days, you could be looking at an additional \$5 million that goes straight to sales.

MPestorius Outside of drug manufacturing, do you see any other areas in the pharmaceutical industry that are ripe for applications of Lean or Six Sigma methodologies?

MK First, there's no limit to potential applications, although limitation of our own resources will demand that we prioritize. Areas that we've seen, besides the R&D area, are packaging and shipping. For instance, one Lean Six Sigma project brought back more than \$1 million in savings just by changing the labeling technique used. There are other less apparent transactional processes, such as the regulatory process — preparing, compiling and reviewing drug submissions and new drug applications.

We've seen it used in inventory control and management. Another ripe area that isn't always discussed is IT. That's a major area that needs to be worked as the dissemination of data and knowledge is really critical to this sector.

MPotosky We agree, Six Sigma does lend itself very well to the supply chain and this is usually the first area where these applications are applied. Today, we are seeing Six Sigma take off in most of our transactional-based areas — IT, Finance, and Service for example. In transactional processes there are cycle time opportunities, defect-reduction opportunities, and customer satisfaction opportunities — all areas where Six Sigma can help. It's unlimited.

MPestorius Whether it's the pharmaceutical or any other industry, the core competencies — marketing, finance, human resources — could benefit from Lean and Six Sigma methodologies.

Colin Wearing At Shertrack, our direct experience is with the supply chain.

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Let me discuss the exceptional return on investment (ROI) that you can typically find in that area. We've had the opportunity to work with Bayer's Business Excellence team, and we were able, through the use of digital modeling, to complement their Six Sigma initiative and expand their ability to deal with complex supply chain issues. To do this, we helped implement an analytic tool that allows them to use quantitative methods earlier in the design phase.

After beginning in the early design phase, these same tools are used in production, so that the implementation and control phases were also more robust and well-connected. As the focus in pharmaceuticals moves away from building blockbuster drugs and becomes a more cost-pressured commodity market, our opinion is that production operations has a lot of money on the table and a real opportunity to make a good ROI in that area.

MPestorius How would one balance the structure that comes with Lean and Six Sigma with the need for creativity and innovation?

CW Those ideas are complementary. Lean allows you to focus efforts on identifying and reducing low-value efforts and low-value activities, which actually frees the time of individuals involved in the overall activity to focus on the more innovative aspects of their processes.

In something such as a pharmaceutical discovery — with a large amount of data and the need to make intelligent selections based on that data — the application of quantitative methods that are inherent in Six Sigma bring significant value to the table, especially when combined with intelligent use of computer models and decision-support tools.

MK I don't think it's as much about balancing this as it is about integrating the two. Although the picture has been painted that Lean and Six Sigma are diametrically opposed to creativity and innovation, I think most people would refute that. The way that we get that balance is through a technique we call systematic innovation, where the innovation process becomes repeatable, reliable and predictable. I don't think any company today, pharmaceutical or otherwise, can afford to bet the future of their company on these "eureka" moments of a select few discovery scientists. It isn't that we don't need those scientists, but I think we've got to find a structure. Lean Six Sigma is a structure that allows for the pulling of the emotional methods of creativity and the psychological methods as well as other structured innovations — techniques like TRIZ — the theory of inventive problem solving, robust design, tolerance design, and other optimization techniques. These are synergistic; people who say that say Lean Six Sigma and innovation are opposites on the spectrum don't know the Lean Six Sigma I know, because innovation is a critical part of the Lean Six Sigma initiative.

MPestorius It sounds like the consensus is that Lean and Six Sigma provide framework and structure for creativity and innovation to flourish. What advice would you give a pharmaceutical company that is considering launching a Lean or Six Sigma initiative?

MPotosky One of the key success factors is to have top-down support — from the CEO and Senior Leadership team on down. But, even with varying levels of top-down support, many companies can be successful following three basic steps. One: focus on your process stability; reduce the variation first and then go after the mean. Two: focus on your customer; solve real problems for them. Three: work on developing your people to be effective problem-solvers; Six Sigma is a recipe and methodology to solve problems. If you can keep that in mind and correctly identify which problems to work on (with support from your leadership), Six Sigma can help your company improve.



MIKE PESTORIUS
Vice President of Six Sigma
SANOFI-AVENTIS

Mr. Pestorius is a Master Black Belt and author of the book, *Applying the Science of Six Sigma to the Art of Sales and Marketing*, as well as multiple articles on the application of Lean and Six Sigma. He is a graduate of the U.S. Naval Academy and Xavier University. He has extensive sales and sales management experience in the electrical, medical and aviation industries. He currently leads a national sales force for a major pharmaceutical firm.



MIKE POTOSKY
Corporate Director of Six Sigma
MOTOROLA

Mr. Potosky is the Corporate Director for Motorola's internal Six Sigma Program, Corporate Director for Motorola University's external Six Sigma Program, and Lead Master Black Belt for Mobile Devices. Mr. Potosky's responsibility for Motorola University's external program is to provide tailored training to companies and individuals in support of their own Lean Six Sigma journey. Training occurs at Motorola's corporate campus and around the world.



MARK KIEMELE
President and Co-founder
AIR ACADEMY ASSOCIATES

Dr. Kiemele has more than 30 years of teaching, consulting, and coaching experience. Having mentored more than 30,000 leaders, scientists, engineers, managers, trainers, practitioners, and college students, he is world-renowned for his Knowledge Based KISS (Keep It Simple Statistically) approach to engaging practitioners in applying statistical methods. Dr. Kiemele has been involved in the origin and evolution of Six Sigma, as he trained the first Six Sigma Black Belts at the Six Sigma Research Institute at Motorola.



COLIN WEARING
Vice-President and CTO
SHERTRACK

SherTrack is a provider of Demand Driven Predictive Manufacturing solutions based on LEAN/Six Sigma. Mr. Wearing has had a 20-year career delivering new software solutions and managing the associated business process change issues for clients in chemicals, plastics, automotive, computer and aerospace industries. As Executive Program Manager for Siemens Product Lifecycle Management, Mr. Wearing led the initial deployment of a new collaboration platform developed jointly with Microsoft.



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MK What we've found is it has to be a special type of DFSS (Design for Six Sigma). Whether you integrate 'define, measure, analyze, design, verify' (DMADV) into the new product lifecycle of a company or not, we find that projects take too long. Companies are not willing to wait a long time for results. So we've developed what we call the study approach for DFSS, where we conduct very quick-hitting studies that generate the knowledge we need at the right time. We've found this to be very useful in reducing cycle time and getting the right knowledge at the right time; that's key.

CW You need to have short projects that demonstrate ROI and that can be used by the champions who sell both up and down their management chain. In addition to that, we've found that there needs to be not only the management support but also a communication path and an involvement and participation of people from each of the cross-functional activities involved. We often see supply chain/production initiatives, and in order to make these effective in reaching the ROI goals, you need to make sure you have the right people from each of the functional groups involved.

MPestorius Lean and Six Sigma are very well-established in other industries. **Do you think the pharmaceutical industry is behind others in using these tools and, if so, why?**

MK There are a variety of reasons. One important one is that the 'we're different' attitude is alive and well in the pharmaceutical industry. To be perfectly honest, the pharmaceutical industry *is* different in that it deals with biological and chemical systems where huge variability exists and higher-order interactions exist more so than, for example, in an electro-mechanical process. However, what is not different is that we still need to do things better, faster and at a lower cost, and there's a lot of misperception out there, too.

Within the process of R&D, output is knowledge. There are strong feelings about the regulatory process; if a company chooses to implement new procedures or technologies, even if they know an improvement would enhance the way they do business, there's fear and trepidation. People might think, 'If we change, extra questions could be raised during the review of the submission leading to delays and requests for additional data, and we don't want that.' So, while there is some truth to this, the government and regulatory bodies need to make a legitimate effort to move the pharmaceutical industry away from that mindset; it's a combination effect. It's what we call in Lean Six Sigma the 'Interaction Effect'. There are initiatives out there like Process Analytical Technology (PAT) and the International Conference on Harmonization that are trying to address these very issues.

MPestorius With the success that the pharmaceutical industry has had for so many years in getting these blockbusters to market and growing and making big profits, is there a certain amount of, 'why do we need to change, we're very successful' attitude?

MK That's a critical reason for the delay: anytime you have high margins, the propensity to change is minimal. But the pipelines are typically drier today than they were five years ago and there's more government oversight, which is going to keep increasing. Change is going to come to this industry whether we like it or not.

MPotosky I am not sure if I would say the pharmaceutical industry is behind. Perhaps the nature of the chemical batch process, highly regulated

"LIKE ANYTHING ELSE,
TRANSFORMATIONS COME WHEN
THE MARKET CHANGES."

— Mike Pestorius

processes, and the general success of the industry has kept Six Sigma out of the limelight. I do know several Black Belts and Six Sigma practitioners in the pharmaceutical industry that have been practicing for five years or more, so there might be a more established Six Sigma environment than you think.

CW Within the supply chain and plan-to-deliver phase, we've seen an increased emphasis on operational efficiency. I think it's in response to macro-economic factors — the fact that it's getting harder to move products out into market; there's more legislation surrounding traceability and approvals, and that the pipelines and margins are starting to dwindle. So, we see the pharmaceutical community becoming more like a commodity-driven business. It's becoming more important for them to have excellence of operations in their production and delivery systems, even to the point that some of their business models are adjusting. A major driver for this change is patented drugs coming off patent and going to generics.

In addition to that, they have challenges in meeting increasingly competitive pressures from a customer-service perspective. There are some macro-economic factors in play that are pushing the historical pharmaceutical model into more of a manufacturing model that is consistent with jet engines and automobiles; they are seeing some pressures that they have been isolated from in the past.

MPestorius Like anything else, transformations come when the market changes and people adjust to survive and thrive. **How do you see Lean and Six Sigma applications, training, and development evolving to meet the needs of the pharmaceutical industry?**

CW Our experience is that people need to have an environment in which they can see the interaction of their ideas and begin to build an intuitive understanding of how the mental model of their operations — be it research or production — interacts with the data models and the tools of Lean and Six Sigma. To that end, what we've found particularly successful is the use of our digital simulation — like a flight simulator — where you can do things offline and evaluate the impact of making various policy changes. This also allows you to do the kind of 'what if' designed experiments — root cause experiments, input-output discoveries — which are needed to build people's confidence and to help them really understand the practical impact of Six Sigma practices. Thus, training and interactive simulation models are one of the things that would be useful to the pharmaceutical industry.

MK There is the belief that Lean and Six Sigma applications — training and deployment — have to evolve to meet the needs of the industry. The way I see it, more often than not, is the other way around: The industry is evolving toward the principles and philosophies of Lean Six Sigma. Evidence of that in the pharmaceutical industry is in process analytical technology and the ICH guidelines; they're important steps. These guidelines and initiatives are consistent with Lean and Six Sigma and are designed to achieve the same effect.

However, there are some methods that will be used more frequently in the pharmaceutical industry than other industries, and DFSS is really key here. We have to use these modeling and predictive techniques, because while Lean and Six Sigma are designed to eliminate risk, DFSS is more geared to managing risk, and that's why DFSS is applicable in the pharmaceutical industry. In the R&D phase, the propensity of data is not there, so we need to have these predictive algorithms and models to use for managing risk.

MPotosky Some other ways that Six Sigma training has evolved is with more on-the-job tools and methods training that has been broken into smaller, more manageable pieces. E-learning is another way that training has evolved — although not everything can be learned electronically. Additionally, there have been great improvements in simulation tools and automated measurement/control systems that help Six Sigma projects drive greater impacts and get completed sooner.

MPestorius While Lean and Six Sigma can be useful in several areas of the pharmaceutical industry, are there any specific areas where you think it should be avoided?

MPotosky: I think Six Sigma can apply to any process within any organization. However, you can't push a rope. Look for where the support is strong and make those areas successful. That will have immense benefit to your program. The places where you're not going to get that support: let them go.

They'll see firsthand the support that the other sectors are provided.

MPestorius Sounds like you feel like it can be applied anywhere, but it may not be a good idea to force it if you don't have the top-down support.

MK Any area that has waste, excessive cycle time, or produces a defective product, is a candidate for applying Lean Six Sigma, but again there are some areas of the company that may not be as early an adapter as other areas. That lends itself to saying we must have a good deployment and implementation process and we have to be able to focus where the greatest opportunities are — selecting the right people, the right projects and the use of accountability, both financial and implementation accountability metrics — they're key to successful deployment. That doesn't mean you can't have success in certain areas of the company that are late bloomers. By getting those quick-hitting successes and demonstrating that this stuff works, any area of the company can benefit from Lean Six Sigma.

CW There's no reason why you can't apply Lean and Six Sigma to any area of a company, but trying to apply a quantitative tool in an area that is immature in terms of its standardization of processes will be difficult. Six Sigma is a quantitative approach, and in the absence of quantitative information, with which to evaluate the efficacy of process changes, you can end up in a situation where you've had a very successful project but there is no way of measuring that success. **FP**

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-Connie Conboy VP Business Excellence, Bayer MaterialScience

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The diagram shows a central 'SNAPPS Probability Model' box. To its left, 'Demand Plan' and 'Virtually Eliminates Impact of Forecast Error' point to the model. Below the model, 'Monitor & sense demand & supply events' and 'Customer Orders' also point to it. To the right, 'Synthetic Order Stream (real + predicted orders)' points to the model. Below the model, 'Probabilistic Inventory Optimization & Scheduling' and 'Determine Optimal Response' point to it. A factory icon is at the bottom right of this section.

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The diagram shows a flow from 'Inputs' (I₁, I₂, I₃) through a 'Process' (X₁, X₂, X₃, X₄) to 'Outputs'. Above the process are 'Process Dashboards' and 'SNAPPS DOE Scenario Scorecards'.

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SherTrack LLC P.O. Box 545, Bloomfield Hills, MI 48303 Tel (734) 462-6220
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