
www.virtualbookworm.com
This
Free
Sample
Courtesy
of
Publishing

THE PIPELINE:

A PICTURE OF HOMEBUILDING PRODUCTION

How RB Builders Learned to Apply
the Principles and Disciplines
Governing Homebuilding
Production.

Fletcher L. Groves, III

“The Pipeline: A Picture of Homebuilding Production,” by Fletcher L. Groves, III. ISBN 978-1-62137-193-9.

Published 2013 by Virtualbookworm.com Publishing Inc., P.O. Box 9949, College Station, TX 77842, US.

Manufactured in the United States of America.

CONTENTS **PAGE**

FOREWORD:

When my friend and colleague Fletcher Groves told me he was writing a book explaining homebuilding production principles and disciplines, I was pleased and supportive.

Fletcher is a man of energy, enthusiasm, and profound experience who has taught me a ton about this fascinating and essential industry (it's been my good fortune to work with Fletcher and the great Jack Suarez on the Inland Homebuilding System).

Fletcher is unique in that he combines a deep knowledge of Lean (also known as the Toyota Production System), Theory of Constraints, Business Process Management, and Finance – a powerful combination. He thereby avoids the tiresome "theological" debates – Lean vs. TOC vs. Business Process Reengineering vs. Six Sigma and so on – that distract and confuse. As Ernest Hemingway once observed, in a different context: It is all true. The point is to integrate powerful ideas toward achieving prosperity for our business, team members, and community.

He is also a man of decency and integrity which comes through in *The Pipeline*'s sub-theme of what the ancients called Fortitude – the guts to confront brutal facts without ever losing faith in the ultimate outcome.

I was lucky enough to grow up professionally at Toyota Motor Manufacturing Canada[1], and to spend extended periods of time at leading Toyota facilities in North America and Japan. Our (very patient) Toyota senseis emphasized the concept of a system – an organized set of parts with a clearly defined goal. Absent a system, at best, we sub-optimize; at worst, we waste our time.

And so, Fletcher has done us a great service. He has produced an engaging and accessible overview of what W. Edwards Deming has called the “profound system of knowledge”, as it applies to homebuilding production. RB Builders, our fictional production homebuilding company, faces the very real challenges, and learns a powerful way of thinking and managing.

Homebuilding has endured a terrible downturn. But it will come back, as it always has. If we can learn and apply the principles explained in *The Pipeline*, if we can learn to think of homebuilding as a system, as RB Builders does in the story, we can blunt future boom-bust cycles, and thereby reduce human misery and preserve hard-won prosperity.

We're early on in this essential journey; a respected colleague suggested that, apart from a handful of progressive companies, homebuilding is where auto manufacturing was a century ago.

The Pipeline: A Picture of Homebuilding Production is an invaluable guide.

– Pascal Dennis

[1] Pascal Dennis is a professional engineer and President of Lean Pathways Inc., an international consultancy. He is a four-time winner of the Shingo Prize for Excellence. For more please visit Pascal's page at www.amazon.com. or www.leansystems.org

PREFACE:

This is the story about a mythical homebuilding company – one that we will simply call RB Builders – and how its cross-functional production team learned the principles of homebuilding production, with the assistance of its intrepid, results-based consultant.

Since it does not offer a central plot, *The Pipeline: A Picture of Homebuilding Production* is not a novel. It is a narrative, a story told in the exchanges of dialog between characters without names, characters who are identified by their respective functions and job descriptions; characters without names does not imply an absence of personality.

RB Builders is a production homebuilding company, so its lessons and efforts in understanding production extend from that context. RB's context of production might be different from, say, a custom homebuilding company, but the underlying principles and disciplines of production are universal; they are what we term production physics, and they have their roots in the laws that govern all manufacturing production.

In many respects, RB Builders is the ideal client for a consulting firm. Its owners are enlightened; its management is competent; its teammates are capable; and most importantly, it has problems to solve. The owners have recently chosen a new path, based on (1) an assessment of current reality; (2) a focused, targeted approach to continuous improvement; and (3) a commitment to a team-based method of performance compensation focused on a single, specific business outcome.

One of RB Builders' most pressing concerns – and one of its most significant limitations to improving business performance – is the lack of a clear, comprehensive understanding of production management.

That is what *The Pipeline* is about.

The Pipeline began life in 2007, at a relatively early point in the Great Housing Recession, as a way of explaining homebuilding production principles and disciplines through a course of dialog. It was written for a particular homebuilding client of SAI Consulting. The client eventually opted for a more traditional narrative, liberating me to write this book a bit differently.

The Pipeline took me five years to complete. The lessons the book contains goes back considerably further.

Almost twenty years ago, when I approached Service and Administrative Institute (as SAI was then known) about the use of its consulting platform in the homebuilding vertical, SAI was a national TQM firm focused on the transportation and logistics space, with a smaller group of engagement clients outside of that vertical in the Jacksonville, Florida market. That group included an aggregates company, an REIT, and other businesses interested in quality management; it also included a major Canadian steel mill.

In those days, Service and Administrative Institute was a State of Florida Sterling Award judge, that also provided quality management training for national companies, including Motorola, Milliken, BF Goodrich, Monsanto, and CSX Transportation.

With its focus on Total Quality Management, SAI was a local and logical platform conducive to where I wanted to focus my efforts. I had just concluded ten years in residential development and construction, including a stint with Arthur Rutenberg Corporation, all of which followed ten years in commercial banking. In some ways, the choice was simple: When you live in Ponte Vedra Beach, Florida, you tend to look for opportunities to work where you live, and avoid having to live where you work.

My joining SAI also coincided with the release of *Moving Towards The Future: A Builder's Introduction to Total Quality Management* by Gary Lewis, published through the NAHB Research Center. It marked the founding of the National Housing Quality award shortly thereafter.

As I labored to develop my own consulting practice focused on the homebuilding vertical, SAI assigned me to engagements with many of its other clients, from which I learned immensely. Those clients were gradually replaced with homebuilding clients. All of that work led to a focus on processes and workflow, in its various versions of Business Process Improvement (BPI), Business Process Management (BPM), and Business Process Reengineering (BPR). This work also lead directly into Lean Production/TPS, Six Sigma, and – most importantly – the Theory of Constraints (TOC).

These and other disciplines formed the basis of what became the firm's new consulting model, after the sale of SAI's transportation and logistics consulting practice to Trimac Logistics in 2000.

As the practice solidified and grew within the homebuilding vertical, almost all of my work came to involve business process mapping, almost always at an early stage of the client engagement. SAI became the industry's foremost practitioner of this narrow and specialized discipline. But – because process mapping focuses on the design, documentation, and improvement of the workflow central to creating the value that customers are willing to buy – these engagements also tended to drive the effort into other areas of needed improvement.

Over the years, these process mapping engagements have been the catalyst that has expanded SAI's work into other areas, including enterprise-wide operational assessments and scorecards, performance measurement and compensation systems, business literacy, and – for a number of clients – the design and codification of the entire production system.

That, too, is what *The Pipeline* is about.

The Pipeline is about a production system with an enduring visual image, the elements of which are crafted to the specific requirements of the homebuilding industry, and the entirety of which is always managed as a system. *The Pipeline* is about using the process management and project management tools that work, without regard to the consulting religion from which they come. *The Pipeline* makes the inherent, inviolable, real, and measurable connection between operating performance and business outcomes.

Grateful acknowledgements for the contributions and roles others played in the writing of *The Pipeline: A Picture of Homebuilding Production.*

The long list of thinkers and writers who were formative to my knowledge and understanding of the methods and management of systems, processes, and project portfolios, formative to my knowledge and understanding of strategy, compensation, and managerial accounting, including:

Eli Goldratt; Jim Womack and Dan Jones; Michael Treacy and Fred Wiersema; Phillip Crosby; James Harrington; Dan Hunt; Dan Madison; Arthur Tenner and Irving DeToro; Alec Sharp and Patrick McDermott; Geary Rummler and Alan Brache; Christopher Meyer; Jerry Harbour; Bruce Silver; Jim Champy and Michael Hammer; Jason Jennings; Bill Jensen; Jim Collins; John Case; Robert Schaffer and Ron Ashkenas; David Maister, Charles Green, and Robert Galford; John Kotter; Dave Ulrich, Jack Zenger, and Norm Smallwood; Merom Klein and Rod Napier; Peter Pande, Robert Neuman, and Roland Cavanagh; Michael George; Mike Rather and John Shook; Jeff Cox; Jim Cox; Rob Newbold; Larry Leach; Sebastian Nokes, Ian Major, Alan Greenwood, Dominic Allen, and Mark Goodman; Bill Dettmer; Lisa Scheinkopf; Gerald Kendall; Dee Jacob and Suzan Bergland; Mark Graham Brown; Bill McGuinness; Jean Cunningham and Orest Flume; Thomas Corbett; Joel Siegel and Jae Shim; and Ray Garrison and Eric Noreen.

Cort Dondero, then-CEO of Service and Administrative Institute, who gave me the opportunity, and the freedom, to develop my own consulting practice; my former colleagues and friends at SAI: Kent Steen, Joe Kinsey, Bob Pues, and, particularly, Steve Hollwarth, who is now mapping business processes at a much higher level.

Mike Hollister, friend, president of Hollister and Associates, Inc., and consulting lead on some of the more instructive engagements with homebuilding clients; Mike was an occasional co-presenter with me at IBS and occasional co-author of *Reference Point*®, SAI's C-Level management survey conducted periodically among the building companies on *Professional Builder's Annual Survey of Housing Giants*.

Pascal Dennis, another friend, a colleague at Lean Pathways, co-consultant on various engagements, Shingo Award-winning author of *Lean Production Simplified*, *Andy & Me*, and *The Remedy*, Poet Laureate of Traveling Consultants (Bloomberg/Business Week), author, as well, of his latest book, *Reflections of a Business Nomad: Stories and Poems From the Road*.

Pascal provided expert insight into Lean/TPS principles and the more-broadly applied area of what is termed Factory Physics, all the while, graciously and patiently enduring my production heresies.

Scott Sedam, president of TrueNorth Development, fellow consultant, fellow writer, who has – through determination and perseverance – succeeded in the adaption and practical application of Lean tools in an industry disparate from whence they originated.

For certain, several of the early-joiners in SAI's business process improvement work, the leaders whose homebuilding companies went on to win either the National Housing Quality

(NHQ) Award, or to earn Builder of the Year recognition from *Professional Builder*, notably: Rob Bowman at Charter Homes & Neighborhoods; Bill and Scott Jagoe at Jagoe Homes.

There are few people in the homebuilding industry from whom I have learned more than my former boss, Art Rutenberg, the always-accessible (he taught me that, too) chairman of Arthur Rutenberg Homes, Inc.

I hope *The Pipeline* repays some of that debt, because ARH is a picture of consistency, discipline, and elegant systems integration on everything related to how much a franchisee makes on each home – and on absolutely nothing related to how many homes that franchisee can produce with a planned, finite, and controlled amount of production capacity.

Art and I agree that we live our lives on opposite sides of the DuPont formula; he is all about margin, and I am all about velocity. The reality is, a homebuilding company needs both.

He tells me my job is easy; I ask him, if what I do is so easy, why isn't he any good at it.

I hope Art enjoys reading *The Pipeline*.

Most of all, I want to thank Jack Suarez – the *great* Jack Suarez, as Pascal acknowledges – good and longtime Tampa friend, third-generation builder, founder and chairman of Inland Homebuilding Group.

Jack listened, reasoned, balanced competing influences, challenged, and pushed; he rejected business-as-usual, he invested in change, and, in so doing, he imposed operating discipline and focus. In the end, he entrusted me with enterprise-level responsibility and the freedom to design solutions for a range of initiatives that coalesced into the Inland Homebuilding System.

From that perspective, the thinking behind the work at IHG went far beyond production principles and disciplines, to the point of defining the underlying Inland business model. It also influenced the SAI consulting model. In that sense, *The Pipeline* is about more than production principles and disciplines; it is about what it takes to achieve the business outcomes – the results – that justify the importance of having a system of homebuilding production.

Absent the influence of Jack Suarez, *The Pipeline: A Picture of Homebuilding Production* probably would not have been written.

– Fletcher Groves, III
November, 2012

INTRODUCTION:

The Pipeline: A Picture of Homebuilding Production is about the principles and disciplines of production management, as they relate to – and as they are applied toward – the specific conditions, requirements, and parameters found in the homebuilding industry.

These principles and disciplines apply to the production operation of every homebuilding enterprise, but they are most applicable to what we term production homebuilding.

I am told that the Introductions written for business books typically answer two questions: Why should you purchase this book? What is the best way to use it – how do we want you to use it?

Why should you purchase this book? In my opinion, you should buy this book, because improving performance on the velocity side of the ROA equation is the best path – perhaps the only path – to achieving sustainable competitive separation.

The issue is not that the margin side of ROA is unimportant – or less important – than the velocity side of ROA. Margin is neither unimportant nor less important; dollar-for-dollar, the Gross Income derived from increasing how much you make on each house you build (margin) has the same value as the Gross Income derived from building more houses with a finite and controlled amount of inventory and capacity (velocity).

Nor is it necessarily a choice. We don't usually have to choose between efforts to increase Return on Sales and efforts to increase Asset Turn; margin and velocity are driven by different aspects of the business, and they don't necessarily react to, or adversely affect, each other.

It's not usually a choice. It's about both.

It is, simply, that higher margin – while as desirable, beneficial, and important as higher velocity – is not a strategy for creating a lasting competitive advantage; between higher margin and higher velocity, higher margin is the easier, more common strategy. The same is even more true of the opposite to higher velocity, which is higher capacity. Adding production capacity (and the inventory for it to work on) is a "more-for-more" proposition. It's the easy, well-traveled road; anyone can resort to adding production capacity, but don't expect it to set you apart.

True, sustainable, competitive separation comes from doing what your competition will not – or cannot – do. Like finding ways to become more productive, to "do more with less".

Consider the plight of RB Builders, the mythical homebuilding company portrayed in *The Pipeline*, facing the world at the close of 2007[2], following the end of the halcyon period known as The Age of Homebuilder Entitlement:

In many ways, RB Builders was a product of that age, just another homebuilding company satisfied with occasionally adopting other builders' "best practices", content to be good, no-

[2]Excerpt from *The Saga of RB Builders*, Fletcher Groves III (2007).

better-but-no-worse than the other builders with whom it competed, a building company with a middle-of-the-road approach to delivering the value its homebuyers demanded.

The previous 10 years had been good for RB Builders. But, it was becoming a dangerous approach to business, because – as the saying goes – "the only thing in the middle of the road are yellow lines and dead armadillos".

It was becoming a homebuilding no-man's land.

Locked into an operating model – into organizational structures, management systems, processes, cultures, and employees – that could not deliver extraordinary levels of distinctive value, the company found itself dumped into a teeming mass of homebuilders that all looked the same, sounded the same, and priced the same. Indistinguishable from other builders, and unable to create any type of competitive advantage, RB Builders was trapped and sinking – like a modern-day dinosaur – into the tar pits of average-ness.

The world doesn't need any more average homebuilding companies; it has enough of them, plenty of them.

The Pipeline: A Picture of Homebuilding Production is structured around the series of team sessions used by RB Builder's intrepid, results-based consultant to build an understanding of production management. It reflects the distinct nature of a homebuilding operation. For a homebuilding company, production management is essentially project portfolio management with embedded production processes and surrounding support processes. Which makes a homebuilding company a project management organization (PMO), and, because it has to manage multiple projects, it is really a project portfolio management organization (PPMO).

CHAPTER I creates the visual image of homebuilding production as a pipeline – its purpose, what determines its size (work-in-process), capacity (output), and length (cycle time), and its cost (fixed overhead). It explains the relationship between cycle time, work-in-process, and output. Chapter I discusses the ramifications of utilization as a choice between higher productivity and higher capacity, and it poses the implications of growth.

CHAPTER II looks at the terms that describe the three actions that occur operationally with money in a homebuilding operation (Throughput, Inventory, Operating Expense), and connects the key measures of operating performance (cycle time, productivity, inventory turn) to the key measures of business outcome (Net Income, Return on Assets) with those terms. The chapter explains the complementary roles that margin and velocity play as the components of economic return, and talks about flow, efficiency, and effectiveness.

CHAPTER III explains "systems-thinking", the discipline of thinking, focusing, and problem-solving that is the context in which homebuilding production must occur, a discipline that is rooted in cause-and-effect, interdependent relationships, ordered behavior and outcomes, the way things work, the way problems are solved, and the way constraints are managed.

CHAPTER IV explains the nuance between systems, processes, value streams, and projects, from a production perspective.

CHAPTER V takes up the discussion of production from the standpoint of how a process deals with variation and uncertainty, and how a process is scheduled. The chapter deals with human behavioral tendencies and the manner in which a production system or process protects (buffers) itself from variation. It talks about the differences and similarities between how proven production methodologies, like Lean and TOC, schedule their processes – pace, types of flow, push v. pull production, balanced capacity v. unbalanced capacity, and buffering.

CHAPTER VI discusses the true nature of homebuilding production as project portfolio management, and re-emphasizes the relationship of differences between process management and project management. The chapter explains the main differences (buffering and resource contention) between the critical path method and critical chain project management, and discusses the important changes that must occur in scheduling, in order for a homebuilding operation to reduce cycle time, and to increase productivity and output.

CHAPTER VII introduces a simple, probability-based, team-oriented production management simulation that uses actual game results to sequence the learning and comprehension of principles and disciplines of homebuilding production in a world of variation and uncertainty, and to tie those principles and disciplines together in an effective business framework.

CHAPTER VIII summarizes the contents of the book – the pipeline, the connection between operating performance and business outcomes, systems-thinking, production systems, managing processes, and managing a portfolio of jobs; describes the elements of the production management system upon which production principles and disciplines must act; and, offers a strategic framework in which *The Pipeline* must operate: the *discipline* of a narrow strategic focus; the *context* of an underlying business logic; and a horizontal *perspective* of workflow and delivered value.

CHAPTER VIII – and the book – concludes with distinguished insight on dealing with dire circumstance: Ronald Reagan on “not being afraid to see what you see”; James Stockdale (Vice Admiral, USN, Medal of Honor recipient) on the paradox of confronting the brutal facts of a current situation, without ever losing faith in the ultimate outcome; Merom Klein and Rod Napier on the candor, purpose, will, rigor, and risk required to find the courage to stay in business and build a successful enterprise.

Regarding the second question, *What is the best way to use this book – how do we want you to use it?*: Personally, I would like to see *The Pipeline: A Picture of Homebuilding Production* used just as it was intended, as a workbook: Highlight it, underline it, write in it, tab it, dog-ear it. Play the game (see Chapter VIII). Challenge its assertions. Ask the questions that will give you clarity. Record your insights about how you would apply the principles and disciplines of homebuilding production to your own situation.

And, then – do something with what you learned.

Enjoy it.

– Fletcher Groves, III

PROLOGUE TO A PIPELINE: "The Saga of RB Builders"

As this story is being told, it is the end of 2007, and RB Builders is embarking on a long journey (previously recounted in *The Saga of RB Builders*) to radically improve operating performance and the resulting business outcomes; at the end of 2007, the beginning of 2008, the company could not have known the depth and duration of the housing and economic recession they had entered. Their intent was to structure first one, then another, then several more projects, each with short timeframes and targeted results, each the logical successive step in the pursuit of its overall goal, each the next step in pursuit of its quest for continuous improvement.

This plan to achieve targeted increases in a single business outcome (in RB Builders' case, Gross Income above a currently-achievable baseline) by driving continuous improvement in operating performance through a series of short duration initiatives with targeted, measurable results was complemented by a team-based performance compensation plan that gave every teammate a financial stake in the achievement of that business outcome.

Very early in this effort, the company had concluded (with the help of its intrepid, results-based consultant/partner) that – among its other, not-so-insignificant problems, and despite its considerable experience and past success – it actually knew surprisingly little about the principles and disciplines that relate to homebuilding production. Moreover, RB Builders really didn't have a picture of what production should look like.

In the past, RB Builders tended to sell as many homes as it could, start them whenever it wanted, and finish them whenever it could. In the company's collective mindset, production was the sum of a thousand independent decisions, made without regard for production as a system subject to – and affected by – events of dependency or relationships of cause-and-effect. However, from its new-found perspective of current reality and systems-thinking, RB Builders was now beginning to see the consequence of its production planning and management.

From a production standpoint, the company had always endured long cycle times (upwards of 180 days), low inventory turns, and an uneven rate of sales, starts, and closings. In the final, halcyon years of "The Age of Homebuilder Entitlement", closing dates came and went, while RB Builders' sales managers gleefully spoke of six month "contract backlogs", as if that were some kind of virtue. The contract backlogs were now a thing of the past, but, strangely, the other consequences of RB Builders' production practices remained.

The internal (production) constraint of previous years had been replaced with an ominous external (market) constraint. Still, as in the past, its trade partners complained about jobs that weren't ready as promised, all the while being tugged in different directions, as the company's superintendents (focused on protecting their individual bonuses) fought for resource availability.

In 2007, RB Builders had 200 closings and an average work-in-process of almost 100 homes; the company's construction lines of credit – still larger than its owners preferred – were usually fully-drawn. In 2005, RB Builders had closed 225 homes with the same average

work-in-process. The GI Baseline for 2008 was based on the same number of closings as 2007.

In the aftermath of the results-based planning that had preceded it, RB Builders' owners made it clear that while the 2008 GI Baseline and GI Target were based on the company finding ways to do more with what it already had, it was their preference to utilize the existing investment in capacity, not reduce it.

CHAPTER I: THE PIPELINE

The intrepid, results-based consultant looked at her watch, stood, and walked to the front of the conference room, now filling with a cross-section of teammates and leaders responsible for production.

On the erasable board, she started a list:

Pipeline

"Okay. We have a lot of work to do", she said. "Over the course of the next few days, we are going to learn the principles and disciplines that govern homebuilding production. We need to create a visual reference, and I think the clearest picture – the best visual image – we can convey of RB Builders' production system is that of a pipeline.

"So – going with that image – what is the purpose of this pipeline?"

"To generate income!", someone said. "To make money. And – to provide jobs for pipeline workers!"

"Yes, indirectly, as an outcome", she said. "In the end, RB Builders' goal is to make money from selling and building homes. Which is not the same thing as its dream, its passion, its purpose, or its core values. The goal of "making money" is a prerequisite, simply one measure of RB Builders' success.

"But – back to the pipeline. What does it do? What is its purpose, what does it carry, and what does it deliver?"

"I would say that the pipeline does two things", offered the VP of Construction. "It carries our work-in-process – it carries houses under construction – and it delivers closings – completed homes. So – its purpose is to produce completed homes, and generate Revenue from the closings that ensue."

The intrepid, results-based consultant added to her list.

Pipeline
Pipeline Size v. Pipeline Capacity
Cycle Time
Work-in-Process
Throughput

“Okay. Then what is the capacity of the pipeline to do that? How many houses – how much work-in-process – can the pipe carry?”, she asked, “How do houses get into the pipeline? And – how many closings is it supposed to produce?”

“As many as we can put in it. However we want to put them in it. Whenever we want to put them in”, one of the superintendents quipped. “Okay – seriously. We’re told we’re supposed to generate an even and sufficient rate of sales, starts, and closings.

“That part makes sense. We just can’t seem to achieve it.

“And – if we could smooth-out our rate of sales, starts, and closings – then we could probably also manage to maintain a consistent level of work-in-process in the system.

“That part makes sense, too.

“But – as for the capacity of the pipe – apparently we think it has unlimited capacity, because every start we put in the pipeline will eventually be completed and closed. As for the output – the throughput, or whatever you call it – that’s a budgeted number of completed houses that turn into closings every year, sometimes we make it, sometimes we don’t.

“As far as how houses actually get into the pipeline, there is a start matrix, which acts as the pipe’s control valve. Under the old production system, the start matrix prescribed both the order and rate of starts, and ‘pushed’ the starts into the system. Under the new production system, the start matrix only prescribes the order; houses are supposed to be ‘pulled’ into the system at the rate of closings.”

“More-or-less”, said the intrepid, results-based consultant. “Let’s go on. I have several questions. First – is there a difference between the size of the pipe and its capacity? Second, how many homes should you have under construction – how much WIP do you need – in order to reach your budgeted closings? Third – how long is it supposed to take you to build a house, and how long does it actually take you? Finally – can you express your budgeted closings as a periodic rate?”

“Regarding your first question – yes – I suppose there is a difference between size and capacity”, said the VP of Construction. “The size of the pipeline would be defined by the amount of work-in-process, while the capacity of the pipeline would be a function of output in relation to size. There is a limit to how much it can hold, so – again, yes – the size of the pipe is finite.

“Regarding your second question – again, yes – there is a connection between how much the pipe can hold and how much it can produce. We think the pipe should be able to hold 100 houses, and we think the pipeline should be able to produce 240 completed houses a year – at least, that’s the budget – which is 20 closings per month. So – you could say that the size of our pipeline is 100 houses, and its capacity is 20 completed houses per month.

“In terms of our cycle time, it varies slightly depending on the house plan, but our construction schedules call for us to average 120 days”, the VP of Construction continued. “However, we

know we are nowhere near that fast. Most of our homes finish late. I would say that eighty (80%) percent of our houses take between 160 and 200 days."

The intrepid, results-based consultant thought for a moment about what the VP of Construction had said. "We are going to presume that all of these completed houses become closed homes, so we will say those terms are synonymous, even though we know there is some additional time; it's not a production issue, and it helps with the principles you are going to learn.

"Now, if you closed 240 homes with 100 houses in WIP, your cycle time would be about 150 days", she said, "30 days longer than expected. However – this year – you are only on track to close 200 homes, which means your cycle time is pushing 180 days."

"Then we agree", replied the VP of Construction, addressing everyone. "The way we measure it, our cycle time has been averaging around 180 days. There is considerable variation, particularly on individual jobs; some take more time, some take less time. But, the overall average is around 180 days."

The intrepid, results-based consultant moved to the erasable board at the front of the conference room, selected an erasable marker, and wrote:

CT = 120 days WIP = 80 houses T = 240 homes

CT = (WIP ÷ T) x Days
(80 ÷ 240) x 360 = 120 days

WIP = (CT x T) ÷ Days
(120 x 240) ÷ 360 = 80 houses under construction

T = (WIP ÷ CT) x Days
(80 ÷ 120) x 360 = 240 closings

"There is, in fact, a direct connection", she said. "There is an accepted, proven mathematical relationship between the length of process cycle time (CT), the level of work-in-process (WIP), and the throughput (T) – or the output – of a process, expressed as a periodic rate. So – if you know two of the values, you can always calculate the third value.

"There are two laws of production that deal with this relationship. The first one that I just mentioned, which is called Little's Law, and a second law, one which we call the Law of Variability Buffering, which tells us that every system will protect itself from unplanned variation and uncertainty with some combination of – you guessed it – longer cycle time, more inventory (work-in-process), or excess/unused capacity."

The intrepid, results-based consultant wrote:

Systems

"All of which points to the fact that we live in a world of systems.

"The homebuilding industry, the housing and real estate market, and the local and national economies in which a homebuilding company operates – they are all part of a system. The business environment within which a homebuilding company must operate is also a system. These production principles and disciplines are part of a system.

"A homebuilding company is not some loosely-connected set of independent, unrelated parts – a loose collection of processes, departments, systems, resources, policies, and other isolated pieces of a whole. A homebuilding company is both a *system*, and a part of a system – a set of interdependent parts that must work together to accomplish a stated purpose.

"Viewed as a pipeline, production systems have neither unlimited capacity nor unlimited size.

"If you increase (the level of) work-in-process, the only way the system can hold the additional work is to lengthen the pipe. The diameter of the pipe is fixed; if we put more work-in-process in the pipe, it doesn't become a bigger, wider pipe – it just becomes a longer pipe. So – what is the length of the pipe?"

"The length of the pipe is the duration to build a house. It's cycle time", replied the VP of Construction.

"That's right", she said. "Duration – or cycle time – is the measure of the length of the pipe. The longer the pipe, the more time it takes to get from one end of it to the other. In fact, given the same amount of effort, the friction, the increased number of turns, etc., resulting from the added length, actually tends to reduce the output."

A superintendent raised his hand. "Okay. So – are you saying we need a bigger, wider pipe?"

The intrepid, results-based consultant quietly smiled. "Well, that depends", she replied. "Does your production pipeline have a cost?"

"Everything has a cost", said the VP of Construction, turning to the CFO. "Isn't that right?" The CFO smiled wryly, nodded affirmatively, and replied, "Yes – it does."

"So – what is the cost of your pipeline?", she asked, adding to her list.

Pipeline Cost

"Well, we've never thought about it that way", the CFO responded. "I suppose the cost would be whatever we spend to have a pipeline in place. It seems to me that the nature of a production pipeline is that of a relatively fixed object – you know, heavy and difficult to move. I know I wouldn't want to move it. I would say that the cost of our pipeline is all of the expenses we incur every year, to have the capacity to build houses."

"That's right", she replied. "The cost of the pipeline is what we pay every year, in the form of operating costs and resources, to have the use of it. We pay for the cost of the pipeline, whether we use it or not. That puts the cost of the pipeline squarely in the category of non-variable costs.

"Which brings up another point. To understand productivity and production capacity, you must first understand how costs behave (in relation to Revenue), and how you manage those costs on the basis of that behavior.

"On the one hand, you want to *control* your direct, variable costs – meaning you want to reduce the cost. Really, though, what you want to do is extract maximum value from it. Value is the difference between the price you sell a house for, and what it cost you to deliver it. On the other hand, you want to *leverage* your indirect, non-variable costs; those are the costs you expect to incur regardless of the Revenue you generate, and you want to produce as much output (Revenue, resulting in Gross Income) as you can from them.

"So – would a bigger, wider pipe cost more than your current pipe?"

Thinking for a moment, RB's CFO replied, "Yes, it would. There is a connection between the size of a pipe and its cost. There is also a connection between the size of a pipe and its capacity, but that's an issue of utilization. When we invest in a pipe, the cost of the pipe is based on its size.

"So – yes – a bigger, wider pipe would cost more than our current pipe."

"You mentioned utilization", said the VP of Construction. "Our production pipeline is almost always full. So – are you saying that we don't utilize our production capacity?"

"No. Well – maybe", said the CFO. "I don't know how effectively or efficiently we are using the capacity that the pipe was designed to achieve. All I'm saying is that there is a relationship between the size of the pipe we design or buy, and what it costs us. The price of the pipe is related to its size, and that cost is fixed. It's up to us to utilize the investment, to use the capacity."

"That's right. I want to summarize the definitions of all these terms. A pipeline's *size* is defined by the amount of work-in-process it is intended – or designed – to carry", said the intrepid, results-based consultant. "Its *cost* is its Operating Expense, which tends to be non-variable. Its *length* is its cycle time. Its *capacity* is defined as the rate of output – or throughput – a pipeline that size can produce, with a planned, finite, and controlled level (or amount) of work-in-process."

Writing on the board, she continued, "You can turn the definition of capacity around, and look at *capacity* as the level of work-in-process required to support a targeted rate of throughput, but, essentially, it's the same thing."

Size = Work-in-Process
Length = Cycle Time
Capacity = Closings with a controlled level of WIP

Control = Rate of Closings and capacity of the scheduling resource
Cost = Operating Expense and Resources

"Earlier, someone described a *control valve* that allows starts into the pipe", she said. "Actually, there are two control valves. The first control valve is the rate of closings. To our way of thinking, it is located at the end of the pipe. The second control valve is located inside the pipe, and it is the production rate of the constraint resource that schedules all of the other resources. When we say that it is a 'constraint resource', we mean that it is the resource with the least amount of capacity, relative to the demand that is being placed on it.

"The first valve – representing the rate of closings – makes the starts available, and controls the level of work-in-process. The second valve – representing the drum resource or pacemaker – pulls the starts into the system; that constraint resource is formally known as the Capacity Constraint Resource. So – the proposition is not exactly 'close one, start one', it's more like 'close one, start one, as soon as the CCR says you can'.

"The two control valves together enable us to have a pull system, and, ideally, they are synchronized, so that we can, in fact, 'close one, start one'. This staggering or pacing of jobs is known as 'pipelining' in a production system that has to manage multiple projects (or jobs).

"The valves are how you manage the pipeline as a system.

"Lastly – the *cost* of the pipeline is what we pay each and every year – the indirect, non-variable operating costs, and all of the resources associated with those costs – to have the use of it."

"I'm confused", said the first superintendent. "Are we – or, are we not – fully-utilizing the capacity of our production pipeline?"

"I don't think we are", replied a second superintendent. "We've already said the pipeline was designed to produce 240 closings a year with 100 houses in work-in-process. We have the inventory, but we don't have the throughput. Plus, our current cycle time is 180 days, not the intended 150 days, certainly not the 120 days called for by our build schedule."

"We can talk about the effect of long cycle times and why that has happened later", said the intrepid, results-based consultant. "But – I agree – you have not been fully-utilizing the capacity you have been paying to have. We can talk about why that has happened later, too."

She continued the list.

Size and Growth
Adding Production Capacity v. Increasing Productivity

"Right now – let me ask a different question: What were your choices for dealing with the issue of capacity utilization? Before the current downturn in the housing market – something

else we can talk about later – what would your alternatives have been for getting throughput up to the designed level?"

"Based on what I've learned from this discussion, I would say we probably had two options", said the VP of Construction. "We could have added production capacity; technically, that shouldn't really count as an option for increasing utilization, because it alters the designed capacity of the pipe.

"The other option would have been to better utilize the production capacity we already had."

"What is the operational term we use for option two?", she asked.

"We would be increasing productivity?" suggested the second superintendent.

"Exactly", she said. "There are only two choices. You can either add capacity or become more productive. It is a decision that cuts to the core of how you view size and growth. What size is RB Builders?"

"$50 million", answered the VP of Sales. "That was our Revenue for 2007."

"And, that is how most homebuilders would answer the question", she said. "The answer to the question of size is usually about the amount of annual Revenue or the annual number of closings. However, the most relevant measure of the size of a homebuilding company is the amount – and the value – of the work-in-process that it carries.

"Size is about capacity, not output.

"As we have already seen, there is a direct correlation between work-in-process and production capacity, which we prefer to define as the rate of throughput (or output) that can be generated with a planned, finite, controlled level of work-in-process. There is an equally strong and direct correlation between work-in-process, cycle time, and velocity (or Inventory Turn). Finally, work-in-process is one of the ways a production system will protect itself – buffer itself – from variation and uncertainty."

"You mentioned growth along with size", the CFO reminded her.

"Yes, I did", she said. "If size is defined as capacity, rather than Revenue or closings, what is the implication for growth? How should RB Builders grow?" Noting the blank stares all around the room, she continued. "The answer, based on that definition, is that RB Builders should *not* want to grow.

"By that definition, even when faced with acceptable justification, RB Builders should see growth as a last resort. RB Builders doesn't want to add production capacity, it wants to increase its productivity, by increasing the utilization of the production capacity it already owns.

"Adding production capacity – getting bigger – is a 'more-for-more' proposition", she continued. "It's the easy road. Anyone can do it. Anyone can resort to adding production

capacity, resort to spending more money. True, sustainable competitive separation comes from doing what your competition will not – or cannot – do. Like finding ways to become more productive.

"Beyond the competitive aspect, there are other problems that come from simply being big", she said. "Big homebuilding companies tend to be slow, clumsy homebuilding companies, unable to respond quickly to changing circumstances, incapable of exploiting opportunities in the marketplace.

"And – there is risk," she added. "Adding production capacity means additional work-in-process and additional resources. Risk increases exponentially with an increase in core size – with higher WIP and Operating Expense. Once you increase production capacity, it becomes much harder to fully utilize it. There are fewer options. It is very difficult to downsize your way out of excess production capacity. Size forces you into positions you shouldn't be in; size forces you down roads where you shouldn't go.

"Okay – so let's talk about the other option," she said. "What do we mean by the term 'productivity'? How do you increase productivity? What does it mean to become more productive?"

"Isn't that the same question?", asked the CEO. "Or – is it a different question asked the same way?"

"The question was about productivity", she said, ignoring the interruption. "Any thoughts?"

"If adding production capacity is a 'more-for-more' proposition, then I suppose improving productivity would be a 'more-for-less' proposition", said the second superintendent. "Or, at least, a 'more-for-the-same' proposition."

"Not bad", she said. "So – what does this 'more-for-less' idea look like? How do you measure productivity?"

Turning to the CEO, she smiled and said, "Don't wear yourself out."

The CEO smiled and replied, "Productivity is the relationship between what is produced and what has to be consumed in order to produce it."

"That's right", she said, continuing the list.

Productivity Measures

"From any managerial standpoint – operations, manufacturing, production, or otherwise; from any industry standpoint – auto manufacturing, homebuilding, or any other industry; from any enterprise standpoint – Toyota, RB Builders, or anyone else; from any expert or business leader standpoint – Peter Drucker to Eli Goldratt to Taiichi Ohno, the conventional, accepted formula for calculating Productivity is Revenue divided by Operating Expense."

She moved back to the erasable board, and wrote:

Productivity = Revenue ÷ Operating Expense
Productivity = Output ÷ Input

"Less commonly, you will also find productivity expressed as the ratio between the 'input' and the 'output' of a process", she said. "Either one will do, but the first formula fits best with the correct understanding of what it means to "make money". We will talk about that later."

She continued, "Under either formula, productivity is about what is produced and what is consumed. The 'what is produced' part is pretty clear; we understand what is meant by 'output'. What about 'input'? What is it that is consumed? Is it an asset, or is it a resource?"

"Assets are converted or transformed. Resources are consumed", said the CFO. "Inputs are expenses, just like the first formula."

"That's right", said the intrepid, results-based consultant. "It is an expense. But – what type of expense is it? Is input a fixed cost – like Operating Expense or overhead – or, is it a variable cost?" Turning, she wrote:

Variable Costing

The CFO stood. "Earlier, you used the terms 'direct, variable cost' and 'indirect, non-variable cost' to describe cost behavior", he said. "I could quibble that direct/indirect and variable/non-variable refer to different characteristics dealing with objects and behavior, but – I agree – that ties with the idea that consumption of a resource would make input an indirect, non-variable cost, as opposed to a direct, variable cost, which is really more like the contra-asset associated with our work-in-process. Like a lot of other homebuilding companies, RB Builders has not clearly separated those costs, but there are certainly advantages to variable costing. In fact, those direct, variable costs don't even become expenses until after we close the job out."

"I agree", said the CEO.

"What about us?", asked the second superintendent. "The argument can be made that the cost of a superintendent is a direct cost, but clearly not a variable cost. The same could be said about construction interest, albeit for different reasons. So – what are we?"

"You are an incredibly valuable resource that happens to be a non-variable cost", said the CFO. "But – you", he said, looking at the first superintendent and grinning. "You are a totally worthless, soon-to-be-eliminated-thus-no-longer-non-variable cost."

"I agree", said the CEO.

The intrepid, results-based consultant put the erasable marker down, and waited until the laughter died down and she again had everyone's attention. "We have talked – briefly, and at different times – about how costs are classified", she said. "We mentioned it in the discussion about the cost of the pipeline. It is part of managerial accounting, more a part of the business principles and disciplines you will be learning than the production principles and

disciplines we have been learning. However, we will address variable costing further down the road, because it impacts so many areas of management.

"For now, it will be enough for you to just remember this: In order to understand productivity and production capacity, you must understand how costs behave, and how you manage those costs on the basis of that behavior. Control your direct costs, because they vary in accordance with Revenue. Leverage your indirect costs, because they are more-or-less fixed, and you incur them regardless of how well you utilize those resources.

"There is more to cover, but we have already covered a lot", she said. "It is a very long road. We will get to the rest of it in due time. But – this is what we have covered so far."

Moving back to the erasable board, she walked the team back through each of the points she had previously listed.

Pipeline

"We said the best description of a production system was a pipeline, and we want to be clear on its *purpose*, on its *size*, its *capacity*, and its *cost*."

Pipeline Size v. Pipeline Capacity

"We said the size and capacity of a pipeline are not the same thing. *Size* is defined by the amount of work-in-process it carries. *Capacity* is the rate of throughput (or output) in relation to the size of the pipe."

Cycle Time
Work-in-Process
Throughput

"We saw that there are three measures – the length of cycle time, the level of work-in-process, and rate of output (or throughput) – that are crucial to our understanding of production and how production systems are managed. These measures are connected to each other – each affects the other two."

Systems

"We said that we live in a world of systems – a set of interdependent parts that must work together to accomplish a stated purpose. Systems-thinking is not sum-of-the-parts thinking. Our beliefs about systems has tremendous implications for everything we do."

Pipeline Cost

"We learned that the *cost* of the pipeline is what we pay every year, in the form of operating costs and resources, to have the use of it. We pay for the cost of the pipeline – for the cost of the capacity – whether we use it or not. We own the pipeline.

"And – right now – RB Builders is not utilizing its investment in its production capacity the way it should."

Size and Growth
Adding Production Capacity v. Increasing Productivity
Productivity Measures

"We said that the choice of whether to add production capacity or improve productivity cuts to the core of how we choose to view size and growth. We don't want to become larger, by adding production capacity. Instead, we want to become more productive, by removing waste and variation, by making our production flow.

"We want a proposition that is about 'more-for-less', not one that is about 'more-for-more'.

"We saw the risk of simply becoming bigger, instead of embracing the discipline of becoming more productive. And – we learned what productivity is, and how it is measured. Productivity is about what is produced and what is consumed in order to produce it."

Variable Costing

"Finally – we learned the importance of understanding how costs behave in relationship to changes in Revenue, and how we manage those costs on the basis of that behavior. Variable costing is really managerial accounting, and it is discussed in more detail as part of RB Builders' business principles and disciplines.

"But variable costing is also central to our understanding of production capacity and productivity. Some costs – our direct, truly-variable costs – we need to control and extract maximum value from; other costs – our indirect, non-variable costs – we need to leverage."

The intrepid, results-based consultant capped the erasable marker, set it down, and moved closer to the group.

"This was a good start", she said. "Think about what we have learned, and begin to find ways to apply what you have learned in your decision-making. Next session, we will pick up where we ended, and begin to connect key measures of operating performance to key business outcomes, from the standpoint of production.

"You did great. You were a very attentive, very engaged group. I appreciate your efforts."

CHAPTER II: THE CONNECTION

The intrepid, results-based consultant finished her catered-in-the-conference-room buffet-style breakfast (two scrambled eggs medium, two strips of hotel-style honey-maple bacon, spicy corned beef hash, breakfast potatoes, buttered Cuban toast with fresh guava preserves, fresh-squeezed orange juice from a remote grove in Highlands County, black coffee, and a palate-freshening dollop of grapefruit sorbet), and moved to the front of the conference room.

"In our last meeting, we talked about the image of production as a pipeline", she said. "We also acknowledged, that while 'making money' is RB Builders' goal, it is not the same as its purpose, passion, dream, or measures of success. So, today, we want to begin to connect the business outcomes reflected in that goal to the operating performance that drives it.

"We talked about this connection in the context of the business principles and disciplines we have been learning elsewhere, but it is also relevant – essential, really – to a proper understanding of production principles and disciplines, so", she continued, "someone please remind us 'what happens to money' in a homebuilding company, from an operational perspective."

"We receive money from closings, we use some of our money to build the houses, and we use some of our money to pay our bills", someone said. "Oh yeah – and the owners keep some of it".

"Or lose some of it. The owners haven't had much to keep lately", said the CEO.

"More-or-less", said the intrepid, results-based consultant, responding to the first answer. "As part of the new focus on results, RB Builders' owners are giving everyone a financial stake in achieving an improved level of operating performance and business outcomes. However – team-based performance compensation is not what we're here to talk about right now.

"RB Builders generates money from closings", she said. "How much money?"

"In 2007, we closed 200 homes for $50 million. So – our average sales price is about $250,000. That's all money we generate from closings", said the VP of Sales. "That's also our baseline for next year."

"But, we don't get to keep all of that money", said the CFO. "If you look at the HUD-1, it might look like that's what we get to keep, but that's a timing situation, and – not with us, but with some builders – it can also be a financing situation. In any event, we only get to keep the Revenue generated by the closings, less the truly-variable costs associated with the land, the cost of building the house, perhaps the construction period financing, and the selling and