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**Enhancing the SME NPD Process through Customer Focused
Design Activities: A New Zealand Case Study**

**James McIntyre
Masters of Product Development
Massey University – Auckland
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Abstract

Small to Medium Enterprises (SMEs) face enormous financial risk when embarking on a new product launch. SMEs are less likely to implement more formal risk minimization strategies for new product development (NPD) such as StageGate, often citing reasons of resource constraints or the more prevalent notion that “this stuff doesn’t apply to us”.

Two key elements of any such risk minimization strategies are an early emphasis on benchmarking competitors and a thorough study of the attitudes and behaviours of potential customers. The SME’s investment of time and resource in early acquisition of this knowledge is a critical factor for success (Cooper 2001). Armed with this information, the SME is able to adopt a Customer Focused Design (CFD) strategy, whereby the product development effort remains focused on the external customers wants and needs through all phases. SMEs that are able to satisfy these needs more effectively enjoy an obvious competitive advantage (Matzler and Hinterhuber 1998; Lüthje 2004).

SMEs are often challenged by these tasks (Freel 2000; Larsen and Lewis 2007; Owens 2007). They may be overwhelmed by the prospect of expected costs, lack of expertise, and financial pressures to rush to market. Too often the more conventional path is chosen, whereby a solution is proposed, developed and tested in the market to “see if it sticks”. Such methodologies are less effective and subject the SME to increased financial risk.

International studies of SMEs attitudes and behaviour towards NPD reveal common challenges of resource limitations, skills deficiencies and organizational issues (Xueli, Soutar et al. 2002; de Jong and Vermeulen 2006; Siu, Lin et al. 2006; Murphy and Ledwith 2007; Owens 2007). New Zealand firms are no exception, and are burdened with similar challenges as their international counterparts.

This study aims to propose a simple framework for small firms who wish to acquire knowledge about their target markets and potential customers with limited time and resources. The framework enables SMEs to incorporate customer focused design principles into their product definition phase, and better orient themselves to the consumer marketplace.

The study makes use of a New Zealand based case study to evaluate how the framework may be employed to identify quick and inexpensive efforts that can reproduce some elements of more sophisticated CFD and benchmarking methods. The obtained results are incorporated into a product design specification and embodied into a physical prototype to further illuminate the process. In addition to the primary area of study, prospects for new adjacent product lines and new potential markets for future development are also gained from the research.

Table of Contents

1.	Introduction	8
1.1.	The Role of Small Medium Enterprises (SMEs) in New Zealand	9
1.2.	The StageGate Process: an Industry Standard for NPD activities	13
1.3.	Opportunities to Enhance Front-End NPD Processes through Customer Focused Design	16
1.4.	Aims and Objectives of this Research	18
2.	Literature Review	21
2.1.	An SME Perspective of NPD Activities	21
2.1.1.	Specific Challenges to Innovation Faced by SMEs	22
2.1.2.	Operational Advantages of SMEs	30
2.1.3.	SME Strategies for Market Innovation	32
2.2.	Customer Focused Design	34
2.2.1.	Methods to Acquire Customer and Market Knowledge	36
2.2.1.1.	Netnography and Online Survey Methods	39
2.2.1.2.	Ethnography	43
2.2.1.3.	Lead User	48
2.2.2.	Integrating Customer Focused Design Principles	54
3.	Methodology	59
3.1.	Research Methodology	59
3.2.	Justification of Research Method	60
3.3.	Criteria for the Case Study	64
4.	A Proposed Framework for Enhancing SME NPD through Customer Focused Design	65
4.1.	A Proposed Framework for Acquiring Customer and Market Knowledge	65

5.	Customer Focused Design Case Study	73
5.1.	Selection of the Case Study	73
5.1.1.	Company Overview	73
5.1.2.	Current NPD Structure and Behaviour	75
5.1.3.	Product Focus: Vehicle Mounted Bicycle Carrier	79
5.2.	Application of the Customer Focused Design Framework	84
5.2.1.	Online Search	84
5.2.2.	Retail Interview	86
5.2.3.	Field Image Capture	87
5.3.	Results of Customer and Market Research Case Study	87
5.3.1.	Online Search	87
5.3.2.	Retail Interview	94
5.3.3.	Field Image Capture	99
5.4.	Incorporation of Results into the Development of a Prototype	107
5.5.	Comparative Efficacy of Customer Research Methods	113
5.6.	Market Position Summary: Strengths, Weaknesses, Opportunities and Threats (SWOT)	114
6.	Discussion	118
6.1.	Comparison of Results to SME Literature	118
6.2.	Efficacy of the CFD Framework	120
6.3.	Generalization of the Results	123
6.4.	Limitations of this Research and Suggestions for Future Study	125
6.5.	Implementation of the CFD Framework	128
7.	Conclusion	131

8.	Appendices	134
8.1	Vendor Survey Data	134
8.2.	YouTube Survey Data	140
9.	References	147

List of Figures

	Page	
Figure 1.1	StageGate Model	14
Figure 2.1	Cooper's Ideation Survey Results	38
Figure 2.2	Quality Function Deployment Matrix	55
Figure 2.3	Kano's Model of Customer Satisfaction	57
Figure 4.1	Concept Mapping	69
Figure 4.2	A Proposed Framework for Acquiring Customer and Market Knowledge	71
Figure 5.1	Informal Development Process for Aftermarket Products	78
Figure 5.2	TREK Mountain Bike circa 1990	80
Figure 5.3	TREK "Downhill" Mountain Bike circa 2008	80
Figure 5.4	EZI-GRIP II Towbar Mounted Bicycle Carrier	81
Figure 5.5	Towbar Mounted Bicycle Carrier with Bicycle Mounted	81
Figure 5.6	Competitor A's Two Prong Design	83
Figure 5.7	Relevance of Video Data Obtained from YouTube	88
Figure 5.8	Typical Carrier Overview and Installation Video	93
Figure 5.9	Innovative Features	93
Figure 5.10	User Innovations	93
Figure 5.11	Adjacent Ideation	93
Figure 5.12	More Expensive Rear Mounted Carrier	93
Figure 5.13	Unknown Manufacturer's Folding Carrier	100
Figure 5.14	Roof Mounted Bicycle Carrier	100
Figure 5.15	Competitor's New Product Entry	101
Figure 5.16	Typical Usage of Pronged Carrier	101
Figure 5.17	Multiple Bicycle Loading	101
Figure 5.18	Difficultly Experienced with Multiple Mount	101
Figure 5.19	Problematic Single Mount	102
Figure 5.20	Carrier Storage	102
Figure 5.21	Inner Tube Securing Restraints	102
Figure 5.22	Home Fabricated Towball Fitting	102
Figure 5.23	Inner Tube Securing Restraints	103
Figure 5.24	User Added Cushioning	103
Figure 5.25	Work Stand	103
Figure 5.26	Triathlon Style Seat Rack	103
Figure 5.27	Trailer Mounted Bicycle Carrier	104
Figure 5.28	Rear Wheel Stand	104
Figure 5.29	Concept Sketch A	109
Figure 5.30	Concept Sketch B	109
Figure 5.31	Concept Sketch C	109
Figure 5.32	Cam Development	110
Figure 5.33	Initial Folding Assembly	110
Figure 5.34	Prototype nearing Completion	110
Figure 5.35	Completed Prototype	111
Figure 5.36	Single Bicycle Loading	111
Figure 5.37	Double Bicycle Loading	111
Figure 5.38	Foam Pad	111
Figure 7.1	A Proposed Framework for Acquiring Customer and Market Knowledge	128

List of Tables

		Page
Table 1.1	Regional Comparisons of SME Definitions	10
Table 1.2	Distribution of Firms within New Zealand	11
Table 5.1	Categorical Results of YouTube Survey	89
Table 5.2	Manufacturer and Model Results from YouTube Survey	91
Table 5.3	Summary of Innovation Observations from YouTube Survey	92
Table 5.4	Product Characteristics Derived From Customer Data	108
Table 5.5	Comparison of Customer Research Methods	113
Table 5.6	Strengths, Opportunities, Weaknesses and Threats (SWOT)	114
Table 6.1	Suggested Suitability of Research Methods	126

1. Introduction

Small and Medium Enterprises (SMEs) are a large and vital component of most developed nation's economies. The prevalence of such firms is so large that in sectors such as manufacturing, their numbers dominate the economic landscape (Larsen and Lewis 2007). The economic importance of such enterprises cannot be understated. Their accrued success contributes substantially to employment, exports, and Gross Domestic Product (GDP). The sheer quantity of firms and their individual contributions build flexibility and robustness into a nation's economy. Governments generally recognize this fact (Massey 2002) and support innovation in SMEs through funding research and incentive programs.

In order for SMEs to be successful, they must innovate as large corporations do. The ability to launch new products and services is a critical element of success for all companies, large and small. Launching a new product or service is often the most significant financial risk a firm may face since its own inception. New product launches are typically characterized by large expenditures associated with research, production tooling, marketing and promotions. The successful recovery of expenditures and the prospect of generating profits depends entirely upon the product's success in the consumer marketplace. The losses incurred from a failed product can be devastating for the small organization. In one study of SMEs based in the Netherlands, 40% of firms were found not to survive their first 5 years in business (Vos, Keizer et al. 1998). Surveys of NZ SMEs indicate that the risks are well understood; however, NPD is still identified as a weakness within their organization (McGregor and Gomes 1999).

Innovation poses inherent risks, yet remains an essential activity of businesses both large and small (Boag and Rinholm 1989). While SMEs are typically described as being more entrepreneurial "risk-takers" than their larger counterparts, in reality their situation

may be more precarious. Small businesses are often more sensitive to the risks of new product development (NPD) activities due to limited financial resources. Indeed, an unsuccessful product introduction can spell disaster for the small business.

In order to cultivate and maintain innovation in this important economic engine, it is vital to support SMEs in their efforts to develop new products. This study examines SME attitudes and behaviours during the early and most critical phases of the NPD process: the market and consumer research required to determine a successful product design. Utilizing Cooper's StageGate process (Cooper 2001) as a basis, a simple framework is proposed to structure the acquisition of competitive benchmarking and customer requirements data. The structure is designed to be accessible, expedient and cost effective - specifically adapted for unique requirements of the SME. The framework is evaluated through a product design case study performed in conjunction with a New Zealand based SME.

1.1. The Role of Small Medium Enterprises (SMEs) in New Zealand

“New Zealand is predominantly a nation of small businesses.”
(“Structure and Dynamics”, 2007)

The term Small-Medium Enterprise (SME) is used extensively around the world, with little consensus on a singular numerical definition. The Asia-Pacific Economic Conference (APEC) defines the term in common language as “firms that employ less than 100 people” (Firms that employ less than 5 people are sometimes referred to as “Micro” firms). According to APEC, international definitions vary widely: Canada, United States and China define them as having up to 500 employees, Australia and Thailand use a threshold of 200, and New Zealand considers SMEs as having less than 20 (“What is an SME? SME Definitions and Statistical Issues”, 2003). Individual nations may also increase

the complexity of the definition by further specifying categories based on industry sectors, revenues, assets or other metrics.

Table 1.1 Regional Comparison of SME Definitions

	Business Size Category Definitions (% of Firms)*			
	Micro	Small	Medium	Large
European Commission	< 10 employees (91%)	< 50 employees (7%)	< 250 employees (1%)	- (1%)
UK	< 10 (-%)	< 50 (99.3%)	< 250 (0.6%)	> 250 (0.1%)
Australia	< 5 (68.5%)	5 – 19 (31.5%)	20 – 200 (9.9%)	> 250 (< 1%)

Note: Bracketed quantities refer to reported percentage of firms in that category

Reproduced from “Structure and Dynamics”, 2007

Table 1.1 demonstrates the wide variation in international definitions of SMEs, while only considering only the number of employees. This variation creates difficulties for the researcher attempting to make comparisons across international boundaries. Regionally specific definitions are useful for policymaking purposes within these countries, and there is little incentive to standardize to international definitions at this point.

Howell (2007) alternatively defines SMEs by structure rather than conventional measures. Howell defines an SME as “having one or two layers of management between practicing engineers and the CEO” (Howell 2007). Although this is not a widely accepted method for classification, it is a useful definition when considering organizational behaviour. This system may better capture the internal dynamics of a firm, which are of particular interest for studies of attitudes and culture.

For the purposes of this study, the New Zealand Centre for SME Research guidelines were utilized (Massey and Ingley 2007). These guidelines classify businesses into size categories based on their number of full time employees:

- Micro enterprise:*** *fewer than 5 Full Time Employees*
- Small firm:*** *between 6 and 49 FTEs*
- Medium firm:*** *between 50 and 99 FTEs*

These guidelines were chosen since 1) the study takes place in New Zealand and 2) the majority of firms in New Zealand fall into one of these three categories. A report published by the New Zealand Ministry of Economic Development determined that 99.5% of private New Zealand businesses are categorized as “micro”, “small” or “medium” sized. These firms collectively employ 65.2% of New Zealand’s workforce (“SMEs in New Zealand: Structure and Dynamics”, 2007). The contributions of small and medium sized business to the New Zealand economy are substantial, as indicated by the sheer quantity of enterprises and the population they employ (Table 1.2).

Table 1.2 Distribution of Firms within New Zealand

EC Size Group	Private Sector Firms	
	Number of Enterprises	Employee Count (EC)
0	219695	0*
1-5	80079	187990
6-9	17560	126710
10-19	14341	191730
20-49	7470	220290
50-99	2044	140230
100-499	1380	269600
500+	221	310050

Note: Zero refers to firms with a sole owner/operator and no employees.

Reproduced from (“Structure and Dynamics”, 2007)

The New Zealand economy exemplifies the crucial role of SMEs. The nation’s relatively high standard of living, combined with its geographical isolation creates less favourable growth conditions for large scale manufacturing. These same factors favour smaller, more flexible models of business with an increased domestic focus. Smaller firms were affected by 1988 government policy revisions which removed financial subsidies and encouraged financial self-reliance. The long term results of these policies and the subsequent political and economic climate have created a strong sector of small, yet profitable enterprises (Souder, Buisson et al. 1997).

The role of SMEs in the New Zealand Economy is expected to increase. From the year 2001 to 2006, SMEs accounted for 59% of all new net jobs in the economy. The number of small firms increased 4% between 2005 and 2006 alone (“SMEs in New Zealand:

Structure and Dynamics”, 2007). These trends are expected to continue as the migration of traditional large firm manufacturing jobs to less expensive labour markets continues and smaller, more flexible manufacturing firms will rise to take their place. SMEs will increasingly need to look to innovation and new products as a means to compete on the world stage.

The New Zealand domestic market for consumer goods is relatively small, with a national population of 4.3 million (estimate June 2008). It is therefore a necessary for NZ based SMEs to consider export markets as a strategy to expand their revenues. Small firms are the most common exporters in proportion to their numbers. According to Statistics NZ, 10% of firms employing 6-19 people report actively exporting products, compared with only 2% of firms employing 100 persons or more (larger firms are still responsible for a larger proportion of national exports). The manufacturing sector is identified as the most active exporter, with 41% of firms in this category reporting export revenues.

Innovation is not restricted to larger firms; however, larger firms do identify themselves as innovators more often than their smaller counterparts. Nearly 50% of NZ firms employing 6-19 persons report innovating activity, while 68% of those employing more than 100 report doing so. Companies in the financial services sector top the list of innovators, with 68% reporting such activity. Manufacturing firms follow, with 65% reporting some innovation activity (“SMEs in New Zealand: Structure and Dynamics”, 2007).

Laforet (2008) characterizes innovation activity as somewhat of a luxury afforded to those with the financial and personnel resources to do so, in this case referring to larger firms. She states that “small firms often have little choice but to defend their position”, while larger firms have the resources available to develop more revolutionary products and

technologies. This is a problematic position for SMEs and requires them to think and operate more creatively to compete (Laforet 2008).

1.2. The StageGate Process: an Industry Standard for NPD activities

Volumes of academic research have been conducted to identify the critical success factors for NPD activities, by studying the characteristics of successful companies (Montoya-Weiss and Calantone 1994; Griffin 1997; Sun and Wing 2005). This research is most often based on questionnaires completed by larger firms who are asked to compare their activities against a set of identified best practices. The pool of survey respondents are separated into contrasting groups of strong and weak innovators, based on some measure of success (i.e. number of new products launched in the past year, etc.) and comparisons are made. The majority of research to date has been collected through this quantitative survey-based research approach, often supplemented with conventional interviewing techniques. Surveys of NPD activities have been performed across a wide variety of industry types, though it is usually biased to larger institutions (March-Chordà, Gunasekaran et al. 2002; Huang, Soutar et al. 2004). Studies of similar NPD activities in SMEs tend to be more fragmented, and more commonly based solely on qualitative interviews (Laforet 2008). The relatively informal nature of NPD structures in smaller firms is difficult to assess through conventional survey methodologies (Gawith, Grigg et al. 2007).

The best practices identified through survey-based research have been woven into prescriptive structures for use by firms who wish to minimize risk exposure during innovation activities. The most recognized outcome of these efforts has been Cooper's StageGate process (Cooper 2001). The StageGate model has been widely accepted by industry, particularly in the U.S. The model is used as a strategic framework and the details are often modified to suit each individual firm's requirements. While other methodologies

do exist, none are as widely adopted by industry or extensively referenced in academic literature. The Product Development and Management Association (PDMA) survey data confirms the popularity of the model; nearly 60% of U.S. firms surveyed used some gated methodology to control NPD (Griffin 1997). As expected, such disciplined procedures find a warmer reception in larger firms; only 27% of North American SMEs surveyed report having any formal NPD processes (Boag and Rinholm 1989).

The StageGate model (Figure 1.1) outlines a highly disciplined and intuitive approach to NPD. The model is characterized by a set of progressively costlier and more resource intensive activity “stages” (Boag and Rinholm 1989). Activity stages are interrupted with key decision points or “gates” whereby a decision must be made on whether or not to proceed. By employing this methodology, projects which do not meet pre-established criteria can be killed earlier, avoiding costly expenditures later.

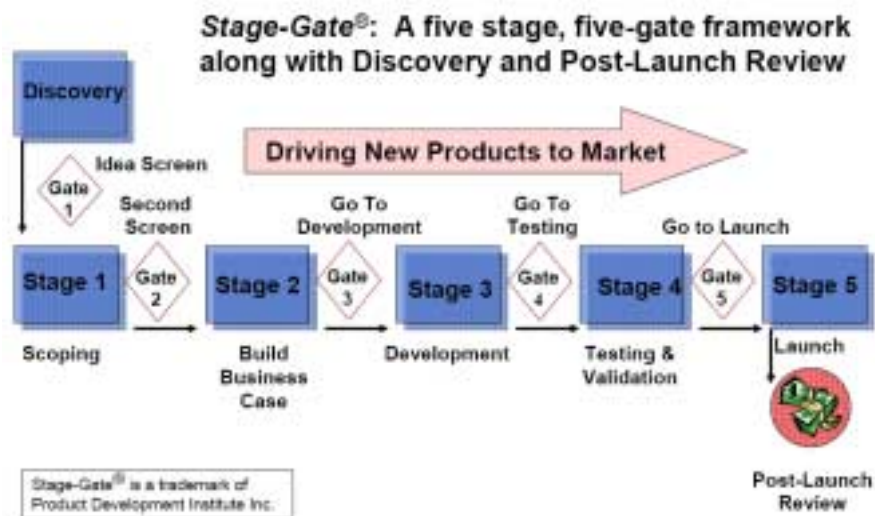


Figure 1.1 StageGate Model
Source: (Cooper 2001)

StageGate is a well known model, and there is little academic writing available that suggests any fundamental deficiencies with it. Most authors recommend some sort of formal process for NPD. Few say it compromises the creative element of design (Boag and

Rinholm 1989). In a survey of the implementation quality of the StageGate process, Cooper identifies the go/kill decision points as the weakest aspect of the process. Nearly 88% of users report some dissatisfaction with their own ability to make effective decisions at these gates (Cooper 1999).

While little documented criticism of the model itself exists, Cooper has published a response to critics of the process. He challenges critics who complain that the process is linear, too bureaucratic, too rigid, and too onerous with respect to individual stage deliverables. Cooper acknowledges that the gate decisions are the most challenging aspect of the model, and points out that no development process can be a substitute for capable decision making (Cooper 2008).

Perhaps more insightfully, Cooper identifies a list of potential “blockers” to successful NPD efforts. Some of these include “ignorance of NPD procedures”, “lack of skills”, “lack of discipline”, “too much of a hurry”, and “too many projects with not enough resources”. Particularly relevant to the issue of customer research, Cooper notes the additional pitfall of being “too confident: we already know the answers” (Cooper 1999). Many of these comments resonate strongly with the typical plight of the under-resourced SME.

Cooper attaches special importance to the early stages of the new product development process. The “Business Case” stage (Stage 2) of the NPD process is most critical to success. Most product failures can be attributed to failure to execute in this area (Cooper 2005). Generating a business case to proceed with a new product idea requires background research to provide an in-depth understanding of the both the customer and the marketplace into which the product will be introduced. Competent knowledge of these two aspects will enable the product developer to identify a properly differentiated product that offers superior value to the customer, by meeting and exceeding their requirements (Cooper

2005). Knowledge of the marketplace requires an understanding of the potential size and trends of the product market, current and future competitors, and each competitor's products pricing and feature advantages. Knowledge of the customer requires study of a customer's wants and needs, both stated and unstated, and their anticipated use of the product, both observed and unforeseen. The firm must be familiar with the lifestyle of the customer, their attitudes and values, and the circumstances of their lives that will directly or indirectly interact with the proposed product.

The firm which can successfully acquire this knowledge and maintain its focus on the customer throughout the product design effort, can exploit the competitive advantage that customer focused design offers (Moll, Montaña et al. 2007).

1.3. Opportunities to Enhance Front-End NPD Processes through Customer Focused Design

While structured approaches have been successfully implemented in larger firms, smaller organizations are found to be less enthusiastic about incorporating them and struggle to adopt and make use of them (Enright 2001). The reasons for this are varied and not well understood. Many SMEs operate without the benefit of academic partnerships and may simply not be aware of the research available. Others may recognize that structured NPD approaches generally cater to the specific needs of larger firms and the results may impose unnecessary bureaucracy on the smaller organizations. Entrepreneurs may be apprehensive to the more theoretical nature of academic research, rather preferring to "figure things out for themselves".

Since the StageGate model is formulated from surveys of best practices of the larger firms, it reflects those aspects of large firms which are thought to make them successful. It is generally recognized that smaller firms are distinct in both principle and practice from their larger counterparts. Successful large firms deal efficiently with multiple project ideas,

communications involving large numbers of participants, and documentation to retain and share corporate knowledge. Smaller firms participating in the NPD process face different challenges. SMEs typically address smaller numbers of projects, involving fewer participants, and enjoy opportunities for more frequent face to face communications. The structured approaches designed for large firms may appear overwhelming and labour intensive from the perspective of smaller organizations with limited resources. The adoption of such a formal structure may be seen as bureaucratic and oppressive, and at odds with the successful entrepreneurial spirit and creativity that drives most small businesses. As a result, SMEs more commonly substitute their own informal processes which better suit their organizational culture, but are difficult to characterize and may or may not be effective.

Both categories of businesses, large and small, have much to gain from studying one another. Larger businesses can learn to be more creative, more flexible and less bureaucratic. Smaller businesses can benefit from being more strategic, more methodical, and by using research data to support decision-making tasks. Since academic research has focused primarily on large companies thus far, a gap remains between the results achieved and the more pragmatic attitudes and behaviours of SMEs. While implementing a rigid scheme such as StageGate may not be achievable or desirable for many SMEs, it is beneficial to identify and extract only those particular elements which may be of immediate benefit.

The most critical aspect of the StageGate process is its focus on early activities. These activities focus on quickly acquiring knowledge of the intended product market and its target customers, and interpreting this new knowledge into a tangible product specification. (Cooper colloquially describes this phase as “doing one’s up-front homework”(Cooper 2005)). A commercially successful product design can be achieved when a thorough assessment of customer wants and needs is compared against the current

offering of available products. Once a suitable position in the competitive landscape can be identified, the manufacturer must integrate the correct set of product features, styling and economics. Success here requires an intimate knowledge of the customer's lifestyle, values and behaviors; the effects of which must be considered at each stage of the product realization. This harmonization of these aspects is often described as "Customer Focused Design". This approach is found to be critical to success, yet often lacking in many SMEs (Freel 2000).

In lieu of a true customer focused design effort, the product developer may choose instead to rely instead on their own assumptions about customer desires. These assumptions may be based on personal beliefs, past experiences or third party information. This approach may seem tantalizing to the SME, since it produces ideas quickly with little expenditure. Unfortunately, this short-cut approach is often a perilous one. Relying on conjecture rather than research embeds inherent risks into the NPD process, since initial assumptions often remain unproven until the product ultimately arrives in the marketplace.

1.4. Aims and Objectives of this Research

Small to medium sized enterprises struggle to fully benefit from customer focused design principles for reasons both real and perceived. While existing research adequately addresses conventional market research techniques, a knowledge gap persists in the research which bridges theoretical concepts with the more pragmatic requirements of the SME. The real constraints of time and resources place a bias on the SME to act swiftly and decisively; customer and market research may appear as a luxury or even a distraction to the task at hand.

The aim of this study is to support SME new product development efforts by developing means which enable them to incorporate customer focused design principles.

The techniques suggested will reflect the nature of SMEs, and suggest accessible, practical and cost effective methods of acquiring customer and market knowledge. The techniques suggested are grounded on established research of ethnographical study and lead user analysis, and make optimal use of current technologies.

There are two specific objectives that are to be achieved towards this aim:

1) *Develop a pilot framework to guide SMEs in the acquisition of knowledge to support customer focused design techniques.*

The principle outcome of this research will be the development of a framework which can be implemented by SMEs who wish to incorporate customer focused design techniques into their product development efforts. The framework seeks to identify those techniques which provide maximum value to SMEs, and best suit the characteristics and specific challenges faced by SMEs.

2) *Evaluate the framework through a product development case study.*

The research will incorporate an actual product development case study which will realistically evaluate the framework and its ability to provide meaningful results to the SME. The case study is intended to clearly demonstrate the effectiveness of customer and market research techniques through tangible example.

The result of this study will be a framework which can be integrated as part of a customer focused design (CFD) strategy by SMEs. The case study approach will validate the framework with a product development example that is supported by actual experience. SMEs may adopt this framework to more effectively acquire market and customer knowledge, and better incorporate these ideas into a customer focused product design practice. Firms which maintain their focus on the needs of their customers and provide creative solutions to address them will inevitably enjoy success in the marketplace (Meyer 2008). Firms which are able to satisfy those needs more effectively than their competitors

will have a clear competitive advantage (Matzler and Hinterhuber 1998; Lüthje 2004). The framework encourages the SME to reduce financial risk by increasing knowledge about the customer and markets, before critical product development expenditures are made.

2. Literature Review

2.1. An SME Perspective of NPD Activities

Research surrounding best practices in new product development generally comes with a bias towards larger firms (Laforet 2008). An attempt to directly apply the results of this research onto smaller firms is based on two problematic assumptions. The first assumption is that that small firms exhibit a structure that is inherently similar to larger firms, only smaller. Closer inspection reveals that small firms are critically different from larger ones in many aspects (Boag and Rinholm 1989; Massey 2002). While generally more constrained by resources, smaller firms are thought to be more informal, adaptive, responsive and creative than their larger counterparts. Large firms will frequently attempt to recreate these small firm dynamics through the use of specialized project teams.

The second assumption is that small firms, if successful, will inevitably grow into larger ones (Boag and Rinholm 1989). However, this is not necessarily so as they may not be able to due to internal skill limitations, external factors or they simply may not desire to expand (Massey 2002).

The consequence of these underlying assumptions is that the suite of best practices that have been obtained from the study of large firms have become the accepted standards to which small firms are compared. Against this standard, small firms often appear lacking in formality, planning and strategy when compared against their larger counterparts. This may be an unfair and misleading comparison (Massey 2002; Allocca and Kessler 2006).

The common feature of large and small firms alike is their requirement to innovate in a competitive marketplace. Both groups face unique challenges and enjoy unique advantages over the other. Studies as to which group has the ultimate advantage have proven inconclusive (Laforet 2008). While larger companies possess the additional resources required to investigate and explore new projects, they are often restrained by their

own procedures and lack the individuality required to think and act creatively. The formalities of larger companies may be detrimental during the idea generation phase, but become positive attributes for the larger firm in the later stages of product development (Laforet 2008).

The most often cited challenge faced by SMEs is their lack of available resources (Freel 2000; Massey 2002; Allocca and Kessler 2006). The resources required for innovation include financial resources, as well as technical, marketing and product development skills. SMEs must apply their creativity to produce superior products in the face of these constraints.

2.1.1. Specific Challenges to Innovation Faced by SMEs

The pressure upon industry to continually innovate remains essentially the same for businesses large and small. SMEs face many of the same challenges as their larger counterparts, such as competitive pressures and the economic climate. In addition, SMEs are often confronted with issues that are essentially different from those which large firms experience. Small businesses are saddled with unique challenges and their behaviours are largely influenced by their circumstances.

Financial Resources

The issue of financial resource constraints are the SMEs most commonly reported impediment to product innovation (Freel 2000; Allocca and Kessler 2006; Kenny and Reedy 2006; Larsen and Lewis 2007). While SMEs face product development expenses similar to larger firms, they typically experience more difficulty in obtaining financing to support this activity (Akgün, Lynn et al. 2004). Smaller companies are forced to rely on their own internal funding and private sources for innovation and R&D efforts (Kenny and Reedy

2006). This limited access to external financing places a more critical requirement on the SME's ability to maintain regular cash flow. SMEs experience increased pressure to accelerate development cycles and minimize delays. Enright (2001) suggests that for this reason SMEs demonstrate an understandable reluctance to take large risks, and are forced to operate in lower levels of innovation.

Investors often associate innovation as a high risk endeavour. Commercial lenders such as banks may not understand specific technologies and therefore may be less likely to offer financing (Perry, Cardow et al. 2006). Many potential investors are apprehensive of SME's informal and improvisational management methods. Calderini and Cantamessa (1997) note that many of the SMEs in their study failed to keep accurate records of incurred costs, and failed to adopt product life-cycle costing principles. Birley and Niktari (1995) (as cited by (Larsen and Lewis 2007)) add that the "poor financial management" exhibited by some SMEs perpetuates investors desire to finance larger, more mature companies. Government agencies seek to fill this gap by providing alternative financing to start-up enterprises. New Zealand's TradeNZ scheme is one example of this type of activity.

Owner Influences

An essential difference distinguishing large business behaviour from small is the often extensive influence of the firm's owner/manager (McAdam, Reid et al. 2004; de Jong and Vermeulen 2006; Murphy and Ledwith 2007). This effect appears to cross geographical boundaries as evidenced by similar results achieved in studies completed in Hong Kong (Siu, Lin et al. 2006), Australia (Xueli, Soutar et al. 2002), Ireland (Murphy and Ledwith 2007), the Netherlands (de Jong and Vermeulen 2006) and the United Kingdom (Owens 2007).

The impacts of an influential owner/manager are observed prominently during the determination of a firm's brand identity and product portfolio. NPD practices are often carried out spontaneously by owner/managers, relying heavily on their own insights and intuitions, with some input from external sources (Siu, Lin et al. 2006). The net effect of such influences can produce mixed results.

There are positive effects of strong, influential leadership. Cooper and Kleinschmidt (1996) identify strong product leadership as a critical factor for success for firms of all sizes. Ledwith (2000) applies this statement to smaller firms by pondering the obvious; "Top level support is critical – how otherwise in an SME?" An influential champion has positive effect on the speed of innovation, often accelerating the process (Allocca and Kessler 2006). Chee Meng and Souder (1994) suggest that while the authoritative capacity of program managers was found to be successful in conditions of low technological uncertainty, the effect is not as evident in more complex situations where a higher technological uncertainty is encountered.

The effects of an influential owner/manager are more commonly associated with negative consequences to the firm. These influences are often expressed as a sense of frustration experienced by those working within the organization (McAdam, Reid et al. 2004). The effects may also go as far as to inhibit the overall growth potential of the organization (McGregor and Gomes 1999).

The influence of the owner/manager on an SMEs innovation capacity is inevitably determined by characteristics of the owner's personality (Xueli, Soutar et al. 2002). Murphy and Ledwith (2007) identified that many of these smaller firms were founded by technical entrepreneurs who wished to commercialize a particular product. Hence, many founders of SMEs tend to have a bias towards technical expertise, but with limited managerial experience (Allocca and Kessler 2006). Entrepreneurs with a technical background are

liable to focus their attention on technical details rather than commercialization aspects (Freel 2000; Allocca and Kessler 2006).

Due to their strong influence, the skills inventory of the SME owner/manager becomes increasingly important (Ledwith 2000). SME owner/managers are often weak in marketing and management skills (Oakley and Mukhtar (1999) as cited by (Murphy and Ledwith 2007)).

In their worst realization, the influences of the owner/manager may be corrosive to the firm. Past successes may fuel an ‘over-optimistic view of their own performance’ (Larsen and Lewis 2007). The owner/manager is frequently subjected to competing and conflicting influences, which may cause them to even appear irrational and unprofessional at times (Jennings and Beaver (1997) as cited by (McGregor and Gomes 1999)). The owner/manager may be perceived as having an “autocratic, egocentric, impulsive and unpredictable” management style (Beaver and Prince (2004) as cited by (Larsen and Lewis 2007)). These behaviours can disrupt attempts to formalize team decision making processes (Cooper 2008) and de-motivate employees who view these actions as “meddling” (Allocca and Kessler 2006).

Surveys of SME employees in the U.K. performed by Owens (2007) echo these sentiments, identifying a lack of management support, unrealistic expectations and a lack of strategic thinking as primary complaints with SME management. In a similar survey of Irish SMEs, McAdam, Reid et al. (2004) find that smaller firms describe their management teams as more focused on immediate issues, lacking openness and competence when compared with larger firms.

It can be sufficed to say that while leadership and support of new product innovation teams is necessary for success, the nature of the owner/managers participation is also critical. Owner/managers of small business are generally regarded as tough, individualistic

and propelled by self initiative. To enjoy success, leadership must achieve a complicated balance requiring a mixture of complimentary character traits and managerial skills. Birley and Niktari (1995) (as cited by (Larsen and Lewis 2007)) found that a lack of management expertise was the second most important reason for business failure. Autocratic owner/managers are often adverse to delegation and may skip critical aspects of the product development process (Adams 1982). To be effective leaders, they must go beyond autocratic control (McAdam, Reid et al. 2004).

Marketing Skills

When surveyed, SMEs identify the ability to effectively study markets and become market-driven as a critical task necessary to ensure product success (Chee Meng and Souder 1994; Freel 2000; Xueli, Soutar et al. 2002). Adams (1982) ranks this ability as even more essential than engineering ability. A comprehensive understanding of customers and markets allows the SME to become truly customer-driven and develop products that customers actually want, rather than what the developer “thinks” they want (Larsen and Lewis 2007). Despite this awareness, market study is often identified as a deficient capability within SMEs (March-Chordà , Gunasekaran et al. 2002; Xueli, Soutar et al. 2002; Krake 2005).

SME are often product-centred rather than market-centred (Krake 2005). Many SMEs were conceived around the technical development of some original product offering. The skills inventory of an SME often still resembles this original pioneering structure, consisting of predominantly technology focused people rather than those with marketing experience (Akgün, Lynn et al. 2004). While making use of their limited resources, SMEs often rely on engineers to perform both technical and marketing functions in a dual role. Freel (2000) suggests that technological entrepreneurs are likely to become overly

concerned with technical aspects of a product at the expense of marketing efforts necessary for commercial success.

The net result of this technical bias combined with resource constraints is that SMEs typically do less formal marketing study, and have less marketing resources at their disposal (Allocca and Kessler 2006). SMEs therefore suffer the disadvantage of not being familiar enough with the markets in which they are participating (Akgün, Lynn et al. 2004). Enright (2001) concurs with the lack of formal marketing skills found in SMEs, however he points to a rich “contextual understanding” of customers by the SMEs observed in his study. If their understanding of customers is accurate, this is a highly advantageous position for the SME. However, in the absence of validated information, SMEs may tend to overestimate their knowledge of markets and rely on their own instinct or “gut-feel” to make important design decisions. A rush to get products to market only exacerbates this.

Time & Resource Constraints

Financial constraints invariably limit the SMEs ability to recruit and retain necessary skill sets. They are often unable to offer wage rates competitive with larger firms, or provide employees with as many career opportunities (Freel 2000). Employees of SMEs are more likely to be less specialized, and participate in a wider variety of tasks (Skalak, Kemser et al. 1997; Cooper, Edgett et al. 2004; Allocca and Kessler 2006). Tasks such as R&D are often shared amongst different internal functions. In a 2006 survey of Irish SMEs, more than half of survey respondents reported not having any specific R&D persons (Kenny and Reedy 2006). SMEs are therefore forced to rely on external expertise in certain areas (Adams 1982).

These skills shortcomings require small firms to seek outside resources for success, yet they infrequently do so (Ledwith 2000). Ledwith (2000) notes that SMEs rarely interact

with external organizations. In contrast, larger institutions are more likely to find required expertise through interface with universities (Adams 1982). SMEs are less likely to take advantage of these resources, believing they are “too theoretical” for any practical value (McGregor and Gomes 1999).

Yet another consequence of the financial constraints placed in SMEs is their reliance on regular cash flow for continued operation. This places additional pressure to reduce the cycle time to launch new products. In a survey of UK SMEs, Owens (2007) found that nearly 90% of SME employees felt pressure from management to produce more new products in shorter periods. This situation is made worse by the external pressures of increased market competition and rapid technology change (Owens 2007). Cooper (2001) emphasizes the importance of these external factors, indicating that new products which come to market late but on budget, are 33% less profitable than those on time but over-budget. Shortening the product development cycle improves the SMEs competitive position (Owens 2007). However in the rush to market, some critical NPD activities are often ignored (Owens 2007).

Culture

Filson and Lewis (2000) utilize the following definition to describe an organization’s culture: “Culture is a combination of management’s values, expectations, and preferences about how the organization should behave. It influences how the organization is designed and how it functions”. There is no single attributable cause for an organization’s culture. The evolution of a firm’s culture is a complex mixture of the personalities and leadership styles of management, and their reactions to internal and external conditions.

The most commonly cited observation of SME culture is their focus on short term goals and strategies (Skalak, Kemser et al. 1997; Vos, Keizer et al. 1998; Allocca and

Kessler 2006). Vos, Keizer et al. (1998) describe SMEs as being “locked in a vicious circle” whereby management is fully occupied with solving short term operational problems, and therefore pays less attention to their long term strategy. Filson and Lewis (2000) describe this as a “fire-fighting attitude towards work”. Long term new product planning often suffers as a result (Owens 2007).

SMEs often lack any kind of formal process for developing new products (Enright 2001; March-Chordà, Gunasekaran et al. 2002). Enright (2001) cites the humorous example of one SME employee who commented “We have two steps: step 1 - idea, step 2 - commercialization.”

SMEs attach little value to formal processes, and express disinterest towards them (Enright 2001). By contrast, larger companies are more likely to implement clear structures for managing information and knowledge (McAdam, Reid et al. 2008).

Of the SMEs that do implement formal control strategies, they generally produce better results and consider themselves more successful (Rinholm and Boag 1987). Allocca and Kessler (2006) find an increase in product development speed for those SMEs who adopt some formal process. Clear goals outlined within a formal process structure appear to provide the most benefit to innovation (Cooper 1998; Akgün, Lynn et al. 2004; Allocca and Kessler 2006). Larsen and Lewis (2007) demonstrate that it is a matter of degree; the more process steps used, the better the results.

SMEs who chose not to implement formal procedures generally suffer in their ability to generate organizational learning (Allocca and Kessler 2006; Murphy and Ledwith 2007; Owens 2007). They typically produce less design documentation and are more likely to design based on “rules of thumb” rather than research and evidence (Skalak, Kemser et al. 1997). Filson and Lewis (2000) associate a lack of formal process with issues of project lateness, poor communication between departments, and no clear ownership of the NPD

process. A lack of formal procedure may also lead to conflicting goals, focus on short term requirements and the creation of a “blame culture” (Filson and Lewis 2000) .

Changing the culture of an SME represents the biggest hurdle to the successful introduction of new procedures. Employees may not see the immediate value of new procedures, and resist their implementation (Filson and Lewis 2000). Implementing change requires the organization to first realize its own shortcomings, and re-evaluate long established practices and ways of working (Filson and Lewis 2000). It is not a trivial matter. Any new process must first mesh with the existing inner workings of a company; they cannot be copied easily from one firm to another (Hindson, Kochhar et al. 1998).

2.1.2. Operational Advantages of SMEs

Although SMEs are generally thought to be saddled by constrained resources and lack of skills, they do enjoy some clear operational advantages over their larger counterparts. Their advantages are such that larger organizations will frequently try to emulate SME operational models through small, focused project teams.

Being small allows SMEs to get “closer” to their customers in a sense that more employees within the firm have the opportunity to directly observe and interact with them (Murphy and Ledwith 2007). They are more often involved in the direct selling of their products (Enright 2001). Being more directly involved with customers may account for stronger employee motivation, a condition observed in studies of SMEs conducted by Notebottom (1994) (as cited by (Allocca and Kessler 2006)) and Murphy and Ledwith (2007).

SMEs are generally believed to have greater flexibility (Freel 2000; Murphy and Ledwith 2007) allowing them to respond more rapidly to customer needs, and changing market conditions. Boag and Rinholm (1989) point out that the concept of product

development is in itself an inherently dynamic process, and question if any standardized techniques can alone produce the best results. Allocca and Kessler (2006) suggest a less structured environment may be better suited for the development of more radical innovations. These aspects seem to favour the flexible and informal nature of SMEs. Larger organizations may face the prospect of having more radical ideas “watered down” through the involvement of numerous people.

When compared with larger firms, the less formal nature of SMEs is seen to be efficient and advantageous. SMEs enjoy frequent, informal communication (Skalak, Kemser et al. 1997; Freel 2000) without being constrained by the bureaucracy of larger firms (Freel 2000). Ghobadian and Gallear (1997) sum up this sentiment by describing SMEs as being “more likely to be people-oriented rather than system-oriented” (as cited by (McAdam, Reid et al. 2004)).

Souder, Buisson and Garrett (1997) support many of these arguments during their 1997 examination of New Zealand SMEs along with their larger U.S. counterparts. They find that in comparison, the smaller New Zealand firms demonstrate the advantages of small firms through the following characteristics:

- *employees commingle more freely*
- *more reliance on oral “histories” and communications*
- *traditional management roles are blurred*
- *flatter organizational structures*
- *strong mentoring*
- *more cross-training takes place*
- *lower employee turnover*
- *employees are encouraged to be more venturesome*
- *better knowledge of customer needs*

While many of these characteristics are a reflection of company size, Souder, Buisson and Garrett (1997) acknowledge that background cultural differences exist between the two nations which cannot be isolated from the study.

2.1.3. SME Strategies for Market Innovation

“The World is Flat”
Thomas Friedman

In his bestselling book, Friedman (2006) discusses how the recent developments of internet capacity, international standards and technological improvements have created a “flattening” effect on the global economy. This “flattening” effect describes how efficient and inexpensive telecommunications have levelled the global playing field, providing more opportunities for offshore providers to supply markets other than their own.

Friedman refers to this transformation as “Globalization 3.0” and it marks a departure from the previous era, where multinational corporations were the defining entities of the global economy. In this era, small companies are able to compete with multinationals more effectively than ever before. The revolution in communications through the internet has made distance and borders less significant, and accessing international markets much easier. The transformation is not limited to companies involved in information technologies. SMEs who are engaged in design and manufacturing activities can better communicate with potential customers and suppliers. Firms can utilize the internet to creatively market to and engage clients online, often compensating for their small physical size with a larger web presence.

An increasingly level global playing field presents both a threat and an opportunity for SMEs. SMEs are less confined to their own domestic territories, and can now access larger and potentially more profitable markets. However, they will be inevitably faced with

increasing competition from new challengers large and small, whom enjoy the same new opportunities.

As the competitive landscaping is continually changing, SMEs must also evolve their strategies to remain competitive. SMEs typically cannot directly compete with larger firms to reduce product manufacturing costs (Lee, Lim et al. 2001), and must rather focus on niche markets and product lines with higher profit margins. Larger firms are more able to take advantage of off-shoring labour and material costs.

The most common strategy for the SME is a “niche market” strategy, whereby SMEs develop products to service smaller market opportunities, not seen as important to larger firms (Lee, Lim et al. 2001). In this way, they are able to avoid direct competition with their larger counterparts (Murphy and Ledwith 2007). This situation is tentative and problematic. McAdam, Reid et al. (2008) point out that “Niche markets, once the preserve of SMEs, are now being aggressively targeted by larger companies.” SMEs face the additional risk of developing small markets into larger ones, only to have larger companies move in and compete directly (Lee, Lim et al. 2001).

The ability to effectively launch new products is a key factor for success for companies both large and small (Cooper 2001). The ability to develop and launch winning products remains an essential opportunity for the SME to capitalize on. Laforet (2008) points out that there is no conclusive result as to whether larger firms are able to produce more innovative products than smaller ones, indeed here the field appears more level.

While larger companies typically have more resources to support radical innovation, they may be too bound by conventional thinking and formal process to fully realize their potential (Allocca and Kessler 2006; Laforet 2008). Smaller firms must overcome their limited resources with creativity. Mosey (2005) suggests that SMEs can directly compete with large firms by developing products using novel, simpler technologies. Product

advantage through design can become part of the SMEs competitive strategy. The results of superior design are rewarded with greater market share and increased profitability (Cooper 1999). Ledwith (2000) suggests that product advantage is the most important critical success factor for SMEs. The smaller size and flexibility of SMEs allow them to seek out markets, where product advantage is valued by customers over other factors such as price (Murphy and Ledwith 2007).

Reduced time to market provides another advantage which SMEs may exploit to compete against larger firms (Allocca and Kessler 2006; Owens 2007). Cooper (2001) emphasizes the importance of getting to the market early, as doing so has a profound influence on profitability.

2.2. Customer Focused Design

The term Customer Focused Design (CFD) is a concept which is frequently eluded to, but rarely defined in academic literature. The term here will be used here to define a product design process which seeks external inputs to inspire, guide and validate creative outputs. External inputs refer to those influences that remain outside the firm; namely the customers which will purchase and use products, and the marketplace in which the products will compete for market share. Customer Focused Design provides an adequate description of both of these aspects, since the critical evaluation of competitors also depends on customer perceptions, rather than internal beliefs. The firm which adopts a CFD process will continually seek to acquire more knowledge of customers and markets, and often refer to these external sources to test and validate ideas. In contrast, firms which do not see the value of incorporating external ideas may follow their own unchecked intuitions, and manage the risk of introducing products which have not been properly scrutinized. Businesses are generally thought to be more successful when they are customer focused.

Firms who seek to identify external knowledge about their customer's wants and needs are in a better position to react to it. The desired outcomes are product designs which are sufficiently differentiated in the market, and meet or surpass customer's wants and needs. It is widely agreed that firms which are able to satisfy customer wants and needs more effectively than its competitors enjoy an obvious competitive advantage (Matzler and Hinterhuber 1998; Lüthje 2004). The task of satisfying customers requires an intense understanding of their needs and behaviours, combined with the creative capacity to formulate unique solutions and insert them into the marketplace in a competitive position. SMEs identify the requirement to research customer needs, survey the competitive landscape, and formulate a suitable product as their most difficult task (Owens 2007) and their most critical skill requirement (Freel 2000; Larsen and Lewis 2007).

Successful commercial products are those which are adopted and incorporated into the lifestyles of the buying public. An effective advertising campaign combined with "word of mouth" can increase the number of additional new product adopters, as well as reinforce brand loyalty with existing customers. Matzler and Hinterhuber (1998) point out the effectiveness of this latter strategy; as the expenditure required to retain existing customers is typically much lower than the cost to acquire new ones.

Focusing on its customers can be a critical factor in the small firms ability to successfully launch new products (Laforet 2008). Cooper (1999) observes that firms which combine consumer and market research with a formal method for managing data and decision-making, such as "Voice of the Customer" (VOC) methods, enjoy significantly higher market shares than firms which do not. Despite this, Cooper also finds that this critical phase of product development is still missing in many large organizations. Most firms do not adequately bring customers into the NPD process (Kristensson, Gustafsson et

al. 2004). This situation is even more pronounced in small to medium size firms (Laforet 2008).

2.2.1. Methods to Acquire Customer and Market Knowledge

Customer focused design is a complicated recipe that begins with the acquisition of customer needs and market knowledge. Once the requirements for a new product are sufficiently understood, the difficult process of formulating a creative response to these conditions may proceed. The sources of creative thinking are elusive and difficult to quantify or deconstruct. Customer focused design places and maintains an emphasis on customer needs and market knowledge throughout the design process. In this manner, creativity is continually focused and applied where it may achieve maximum value for the customer.

The most obvious method to determine customer needs is to simply ask them. This can be achieved through traditional one-on-one interviewing techniques. Customers are interviewed identify their problems, rather than their desires and own solution ideas. Too early a focus on problem solving can curtail creative thinking (Matzler and Hinterhuber 1998; Ulwick 2002). While useful results can be obtained, the exercise tend to yield more marginal data since there often remain needs that customers themselves are not aware of or simply fail to recall.

Products developed for mass markets are required to meet the needs of many different types of customers. Statistical techniques must be employed to survey a sample of potential customers, in order to project the needs of a larger population. Griffin and Hauser (1993) provide guidelines as to how this can be accomplished. They determine that comprehensive discussions with customers typically produce a list of 200-400 needs. In a particular study of office furniture products, 16 hours of focus group and 9 hours of one-on-

one interviews produced a comprehensive list of 230 customer needs. When analyzed, the results from a single one-on-one interview identified approx 33% of the total set of needs, two provided 51%, and nine accounted for approximately 90% of the original set.

Ultimately, no less than thirty one-on-one interviews will almost fully reproduce the original list (Griffin and Hauser 1993).

The value of such an exercise certainly produces diminishing returns. By the time 90% of needs have been established and re-established, the importance of those yet unnamed can be assumed to be small. Griffin and Hauser do not illuminate this further, as there are no relative values attached to any need in their research. Too many interviews can potentially produce an overwhelming list of customer needs, especially from the perspective of the time and resource constrained SME. Too many interviews will also lead to time delays, a critical factor in determining the success of a new product (Cooper 2001).

While the standard interviewing techniques seem a straightforward means of generating new product ideas, the means available for gathering information about customers and markets are as diverse as the ideas themselves.

Cooper (2008) investigates the sources of ideation by surveying the usage of eight Voice of the Customer techniques (ethnographic research, customer visit teams, customer focus groups, lead user analysis, customer or user design, customer brainstorming, customer advisory board or panel, community of enthusiasts), six open innovation methods (partners and vendors, accessing the external technical community, scanning small businesses and business start-ups, external product designs, external submission of ideas, external idea contests) and four other ideation methods (peripheral vision, disruptive technologies, patent mapping, internal idea capturing). Over 160 companies were surveyed to identify which methods are used most frequently, and which were rated more effectively. The results are summarized in Figure 2.1.

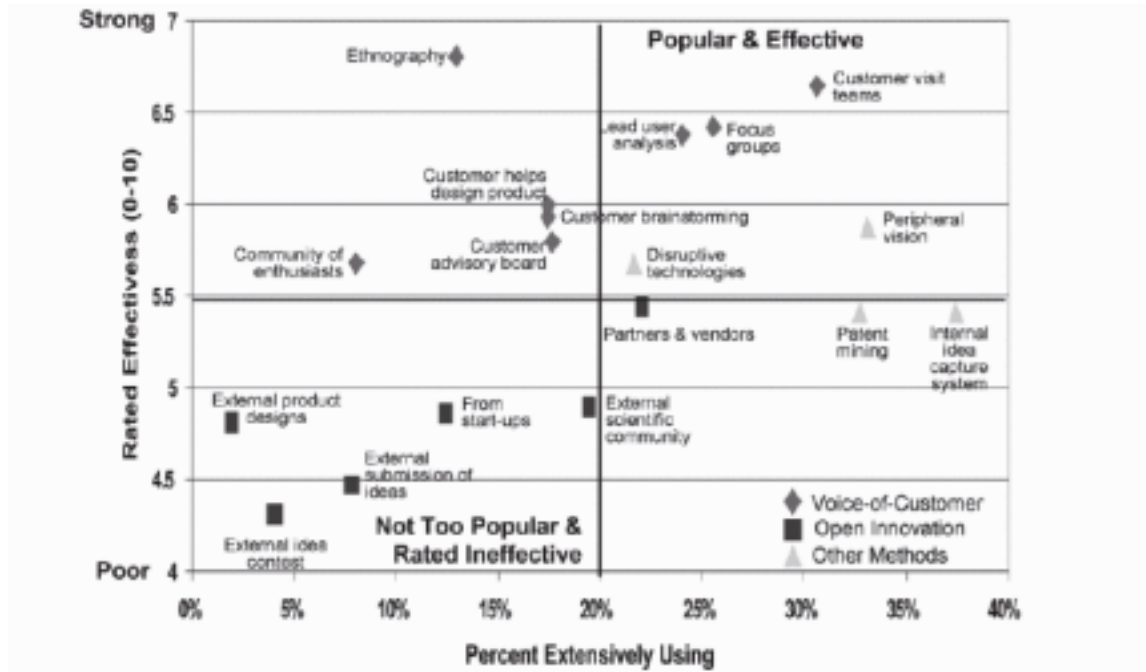


Figure 2.1 Cooper's Ideation Survey Results
 Reproduced from (Cooper 2008)

Cooper (2008) identifies four “Voice of the Customer” methods that are rated as most effective by those firms who employ them:

- 1) *Ethnography* – the study of customers in their natural surroundings
- 2) *Customer Visit Teams* – small teams of cross functional research teams visiting customers and utilizing group interview techniques
- 3) *Lead User Analysis* – working with identified “innovative users” who have implemented solutions to needs they have already experienced, in advance of the general population
- 4) *Focus Groups* – a moderated group of 6-10 persons who are interviewed as a group to determine product ideas and needs

Of these items, ethnography studies are identified as the most effective method for generating new product ideas, however it is employed less frequently than other means deemed effective.

Cooper's results are constrained to the categories which were identified in the survey itself. The results therefore do not identify alternative methodologies which may be utilized by firms, such as harvesting online resources for access to customer and market knowledge.

2.2.1.1. Netnography and Online Survey Methods

The internet is a rich and practically infinite source of data which can be harvested and analyzed for information about potential customers. The benefits of using the internet as a business tool are evident and well understood. Few companies in the world today fail to make use of this fast and inexpensive means to obtain information, disseminate information and communicate globally with partners and clients. With simple search criteria, data can be acquired from a variety of sources to support benchmarking, ethnography and lead user studies.

Communities of practice arise spontaneously on the internet, as they do in real life. Communities form around shared activities, beliefs and interests. These communities exist such that members can talk about their experiences, pose questions, and seek feedback on their own ideas (Franke and Shah 2003; Fuller, Jaweck et al. 2007). Members individually benefit from their own acquired knowledge and a sense of belonging. In aggregate, the shared communal knowledge of the group steadily increases as well.

The internet provides an extremely effective and convenient platform for such groups to self assemble and communicate. USENET and LISTSERV group posting software were some of the pioneering internet based applications to gain widespread use by the public in the early days of internet growth. More recent social networking sites such as YAHOO!Groups, Facebook, MySpace and content sharing sites such as YouTube and Flickr have accelerated the growth of these communities. It is difficult to estimate the sheer

number of community groups active online, however the quantity is vast and the range of topics diverse. The Microsoft Network alone lists more than 20,000 groups devoted to the single topic of automobiles. The majority of participants in these groups are silent observers, or “lurkers”, with a large number of postings submitted by a smaller quantity of more active participants (Füller, Jawecki et al. 2007).

Kozinets (2002) resists the term “virtual” community to describe these forums since the discussions are conducted by real people who form a cohesive group with similar personal connections and a shared sense of community, but may physically reside thousands of miles from each other. They form very “real” communities (Kozinets 2002). The cohesiveness of these online communities resembles that of social groups in the real world. Andrews, Nonnecke et al. (2003) experienced outright hostility by some groups in response to their academic research inquiries. The actions of the researchers were construed as invasive and reacted to with threats, spam mailings and even software attacks on their server. However unfortunate, these acts clearly demonstrate the strong sense of community present in internet groups, and the vigour with which groups will defend that community.

While most often playing the role of passive observer, researchers need to be mindful of the ethical implications of their actions. Information that is freely posted as part of a public discussion comes with implicit consent that it will be reviewed by others. Such comments are most often made under an assumed screen name, so the poster retains some degree anonymity. For this reason, consent is not required before content is utilized. Information that is posted on websites hosted by companies and other organizations may come with disclaimers that must be honoured.

Even though posted discussions become part of the public domain, researchers must not risk upsetting the community and therefore “poisoning the well” for future research.

Kozinets recommends the following code of practice for netnographic study of online communities (Kozinets 2002):

- 1) Fully disclose his/her presence affiliations and intentions
- 2) Ensure confidential and anonymity to participants
- 3) Seek and incorporate feedback from online community
- 4) Obtain informed consent before using any specific postings

The most common method to study customer behaviors through the internet would be to duplicate traditional approaches, while employing internet technologies. Email and web based applications offer alternatives to traditional phone and mail surveys, with faster distribution and response cycles. Response rates however, may suffer. In a survey of 77582 members in 375 online communities, Andrews, Nonnecke et al. (2003) measured only a 2.3% overall response rate. Nearly 5% of the communities requested to take part in the survey refused. Reasons suggested for this result include “survey fatigue”, apathy and mistrust on behalf of requested participants. It seems that people may be more responsive to such inquiries when they have a individual interest in the results, as 96% of those surveyed requested to be notified of the results (Andrews, Nonnecke et al. 2003).

Ethnography is readily understood to be a powerful tool to study consumer attitudes and behaviors firsthand in their native context. This tool is often combined with other more conventional methods such as surveys and focus groups, for the purpose of acquiring specific marketing information. Utilization of the internet to perform such studies may be substituted with similar results, but with reduced costs, increased speed and some less obvious benefits outlined here.

Robert Kozinets coined the term “Netnography” in 1997 to describe marketing ethnography performed over the internet (Kozinets 2002). Netnography refers to study of

online community of discussions as if they were taking place in real space. Similar to ethnography, netnography is a less structured method of studying consumers and is improvisational in nature. In the most straightforward case of this activity, the researcher can simply observe conversation threads in a particular subject area. Using an illustrative example of a community based around mountain biking, the researcher may observe threads related to places to ride, upcoming events, customer product reviews, equipment complaints and proposed enhancements to existing equipment. The researcher may go further to pose specific questions, but should consider the ethical implications discussed later in this section. Discussions around a particular topic, “what kind of bicycle should I buy?” for example, may resemble that of a spontaneous focus group, which is not facilitated. Discussions based on particular activities may be utilized as part of an ethnography study. Online communities centered on hobbies and activities often attract innovative users (Füller, Jawecki et al. 2007) who will freely share their solutions with the community. These provide information similar to that of “lead users”.

Kozinets asserts that “real-life” ethnography is time consuming, elaborate and requires considerable amount of skill and resources. Similar outcomes can be achieved with less effort by making use of the online medium (Kozinets 2002). Kozinets also points out that participants in online discussions do so from the comfort of their own home, as opposed to an unfamiliar setting. This aspect should provide for more relaxed and natural responses from participants, similar to those obtained from ethnography studies (Kozinets 2002).

Others suggest that there are additional benefits of utilizing this technology. Typed communication favors those who may otherwise face apprehension when required to state things orally, such as in a focus group or interview setting. The dynamics of the group itself is also affected, as the majority is less likely to influence individuals (Montoya-Weiss, Massey et al. 1998). While the anonymity of the internet suggests that some might take

advantage to supply false or misleading statements, Montoya-Weiss, Massey et al. remind us that there are “no guarantees of participant honesty, online, in person, or otherwise” (Montoya-Weiss, Massey et al. 1998).

Online communities are also an important consideration of corporate brand management, as they often become a forum for consumer advocacy. Seybold recommends a proactive approach, encouraging corporate clients to create their own online user community to test ideas, solicit customer feedback, and build brand loyalty. Companies such as National Instruments and Hallmark are examples of firms who have successfully embraced this technology as a means to communicate with customers (Seybold 2006).

2.2.1.2. Ethnography

Ethnography has been suggested as a richer, more insightful method of conducting market research than traditional focus groups. Mariampolski defines ethnography as the “Direct contact and observation of the consumer in the natural context of product acquisition and usage” (Mariampolski 2002). The origins of this technique date back to the 1960’s, when it was developed as a tool for study in the fields of sociology and anthropology. Its use in product development research began in the 1980’s. Ethnography has especially effective at characterizing the customers experience in using a products or service (Rosenthal and Capper 2006). This method is alternatively known as “contextual inquiry” (Rosenthal and Capper 2006).

Traditionally, the study of customer needs and opinions utilized focus groups as well as survey techniques. Focus groups were established in the 1940’s as a means to investigate customer reaction towards radio programs. Members of the audience were invited to the studio to listen to programs and provide comment (Langford and McDonagh 2002). This technique was seen as an improvement over individual telephone interviews and mail

surveys. The most obvious benefit of this method was the interviewer's direct interaction with participants. Direct observation of the interviewee allows for the study of non-verbal communication, in addition to the participants comments. Utilizing group setting further enhanced the information gathering, through increased interaction and spontaneous dialogue between participants and the interviewer.

Utilizing focus groups to collect customer data also poses some inherent risks as a research tool. Certainly, any such methodology which requires participants to recall past behaviors is imperfect, and better captured through direct observation (Andrews, Nonnecke et al. 2003). The setting of a focus group may also prove problematic for some participants. More introverted individuals may feel uncomfortable with the group setting, therefore not voicing their thoughts and opinions. In such cases the opinions of the more dominant group members may be accepted as consensus. In some cases, individuals will allow their own opinions to be compromised by the group influence, and a "group think" scenario may unfold (Webb 2002). Leading a focus group requires skilled interviewer to maximize results and avoid such pitfalls. Results obtained from this method of study are heavily dependent on the analyst's review of interview data, as customer comments are translated into product attributes which consumers attach importance (von Hippel 1986).

Ethnography enjoys several advantages over more traditional focus group methods. Mariampolski (2002) identifies several, including but not limited to:

- 1) *Reality based* – it is preferable to interact with study participants in their natural environment, rather than the constructed atmosphere of a meeting room.

Participants are likely to be most cooperative when they feel comfortable in their own surroundings.

- 2) *Use of observation* – use of direct observation reduces the reliance on participant to recall past experiences and behaviours. By observing the participants actions directly, unstated behaviours and unconscious concerns may be identified.
- 3) *Improvisational* – ethnography is by definition an open-ended practice. Kozinets notes that “no two ethnographies have ever been conducted in exactly the same manner” (Kozinets 2002). These improvisational and flexible nature requires a more skilled observer, but may yield unanticipated value in areas such as ergonomics, performance attributes and hidden insights of product strategy and marketing (Rosenthal and Capper 2006).
- 4) *Culturally grounded* – by observing individuals in their native setting, rather than as a composite group, the study benefits from increased focus and sensitivity. By treating participants as individuals, specific cultural differences may be identified which may not have otherwise surfaced in groups discussions.

Market research techniques such as ethnography and focus groups have often been criticized for their qualitative nature. Quantitative data, such as that obtained from telephone or mail survey, can be generalized to a wider population with stated precision. Qualitative results have no such statistical application (Webb 2002). The use of such data has more value as an exploratory tool, to provide a deeper understanding of the customer experience, rather than obliging the customer to comply with the interviewer’s measurement schema. Mariampolski goes further to criticize those more traditional quantitative methods: “marketing discourse has been seduced and clouded by a positivist model of how people think and behave”(Mariampolski 2002). The implication here is that the use of statistical models implies the existence of some kind of underlying predictive mechanism for human

behavior. In reality, human thought and behavior are much too complex for any such model to exist.

Ethnography relies heavily on the individual skill of ethnographer due to its inherent improvisational nature. While every study begins with a list of desired outcomes, it must not limit itself to that list or risk missing some unforeseen benefit. The researcher must be able to quickly react to cues which are presented by the participant, if behaviours and attitudes are to be fully explored.

The ethnographer and those participating in the discussion of results must keep an open mind throughout the process to maximize benefit. This may present a challenge to companies who have already set upon a fixed product strategy, or to those who think they are already knowledgeable enough to accurately predict the results (Rosenthal and Capper 2006).

Ethnography studies are especially beneficial in the early stages of product development, when little is known about a prospective market or before a product concept has been defined. It is useful to establish background information about a potential products usage in its intended environment, as well as those details which may affect its usage such as consumer behaviour, beliefs and attitudes. Information obtained from this type of study may then be used to evaluate a wide range of product concepts so that the most viable is chosen (Mariampolski 2002).

Ethnography studies can take a variety of formats. They can include planned visits with clients, individual “intercept” interviews taken place at the site of an activity, or even passive observations of participation at the customer site (Rosenthal and Capper 2006). The beginning of a study requires careful planning and development of an ethnography guide which specifies the format and desired outcomes of the study. In the case where participants will be actively interviewed, they should be screened for diversity and

willingness to participate. Interviews and observations with participants are recorded using the most appropriate means such as written field notes, photographs and full video recordings. Ideally, no fewer than 15 studies should be conducted to adequately explore a subject (Mariampolski 2002). The value is extracted from this data through analysis and discussion of the meaning of the results. The results are also often combined with more formal market research data to probe and confirm findings (Rosenthal and Capper 2006).

The scope of ethnographic inquiry can be expanded beyond observations of potential product users. Coates insightfully describes the sequence of how the general public may become customers of a particular product and ultimately users of that product. As members of the general public, their attention rests mainly on the aesthetic value of products, having had no experience of them. In becoming consumers, customers must make a purchasing decision and their attention turns to aesthetics, features, value and cost. As consumers become users of a particular product, the “honeymoon” period eventually ends and users focus on the usability of the products they have purchased (Coates 2002). Truly successful products are successful at each experience phase.

Ethnographical study as a tool could be employed at each phase of this transformation. A study of consumers, before they become customers, can be taken in the context of the retail location where purchase decisions are made. Such studies were pioneered by Underhill who studied consumer behavior in retail locations considering factors such as store layout, traffic, signage and the effects of different means of product display. For example, in studying the buying behavior of men, Underhill notes that men shop faster, are less sensitive to price, prefer to find their information at the store, but are less likely to ask for help (Underhill 1999).

Meyer (2008) clearly demonstrates the advantageous role of ethnography by reviewing its use by the Honda Motor Company during the development of the Honda

Element passenger vehicle. Initial demographic study identified a group of U.S. based potential customers, targeting the so-called “Generation Y” male (19-29 years old). This group was measured to be adequate in size and purchasing ability, with the additional advantage of being first time buyers who could be groomed into lifelong customers. Ethnographers were then employed to study this group in its context (in this case even visiting the “X-Games”), to initially identify a theme for the vehicle. Subsequent interviews conducted with potential customers in their own environments, such as college dorms, fraternities and coffee shops allowed researchers to identify the activities of this group and their potential interactions with the vehicle. Key product features such as waterproof interiors, pillar-less doors and flexible seating arrangements were developed to accommodate activities such as surfing, mountain biking and camping. A user group of 30 persons from the demographic group was then assembled to review ideas and provide feedback to further enhance the design. The resulting effort was a highly profitable venture for Honda, nearly doubling their original sales estimates.

2.2.1.3. Lead User

Perhaps the most effective way to study the wants and needs of a potential customer base is to examine what they have done for themselves. Consider the well documented example of mountain biking: In the early 1970’s enthusiasts wished to take their bicycles off road, however current products available on the market were not sufficiently durable and unsuitable for this purpose. Users instead developed their own products for this application, utilizing strong frames, balloon tires and brake components salvaged from motorcycles. Manufacturers eventually became aware of this trend, and began to develop their own mountain bike product lines. They were mass produced beginning in 1982. As of the 2000,

65% of total U.S. bike sales were of this category, representing annual sales of \$5.89 billion (USD) (Lüthje, Herstatt et al. 2005).

This method of product ideation differs from conventional methods in two fundamental ways. Firstly, conventional market research looks to study the “typical user” located at the centre of the market adoption curve. Lead user analysis seeks to identify those users who are ahead of the entire curve (including even those early adopters) and experience needs that will be experienced by a larger group in the future. Secondly, market research is often concerned with studying a group of users to identify problems which customers typically experience. Manufacturers develop solutions and present them back to the marketplace in the form of a new product or service. The study of lead users is different, as solutions are identified from within the customer base for problems which may not yet have been identified (Lilien, Morrison et al. 2002).

Criteria for identifying lead users involve three distinct aspects. Presence of all criteria are essential in determining “lead user status” (Franke, von Hippel et al. 2006). The defining criteria are:

- 1) *They face needs that will be general in a marketplace – but face them months or years before the bulk of that marketplace encounters them* (Herstatt and von Hippel 1992). Lead users are considered to be on the leading edge, ahead of what the general market will eventually define as a need. Urban and von Hippel suggest they may precede mainstream market needs by as much as 7 years (Urban and von Hippel 1988). They are often high intensity users or enthusiasts who are pushing the boundaries of a sport, trade or some other activity. It is this behavior that allows them to experience new needs before others.

- 2) *They expect to benefit significantly by obtaining a solution to those needs* (Herstatt and von Hippel 1992). Lead users will often innovate when no products currently exist on the market, or no existing product meets their immediate needs. The benefit they desire from innovating is primarily intrinsic, that is the enjoyment of using what they develop and sharing it with their peers. Füller, Jawecki et al. report that the majority of innovations shared online are excitement driven (80%) rather than need driven (20%) (Füller, Jawecki et al. 2007). This challenges von Hippel's notion that need alone is the overwhelming innovation driver.
- 3) *They are more likely than other users to innovate when product needs are not currently available* (Urban and von Hippel 1988). Lead users possess the "know-how" to successfully construct and modify their own equipment. They often have technical knowledge of products, materials and manufacturing processes. They can often be identified by a measure of their local resources to carry out product modifications (Franke, von Hippel et al. 2006). Overwhelmingly, lead users find enjoyment in the technical challenge of modifying products.

Franke, von Hippel et al. use the above criteria to classify users into those who demonstrate criteria and those who do not (Franke, von Hippel et al. 2006). When the behavior of these two groups is comparatively studied, and it is found that 82% of lead users had modified some product for their own use, while only 1% of the non-lead users do. It is therefore reasonable to identify lead users as those who modify products for their own needs (Urban and von Hippel 1988). Morrison argues that the degree of lead user activity is a continuous scale, rather than categorical (Morrison, Roberts et al. 2004). Studies suggest anywhere from 10 - 40% of users report having modified their products at some point (Franke, von Hippel et al. 2006). This is supported by a study of sports communities, in

which 32.1% of those surveys report as having innovated in some way (Franke and Shah 2003).

Many innovations identified through study of lead user activities are suitable for commercialization. The degree of high intensity lead user characteristics has a positive impact on the likelihood to yield commercially attractive innovations (Franke, von Hippel et al. 2006). Few lead users will attempt to commercialize on their own. Lüthje studied users of outdoor related consumer goods and found that 37.3% generated at least one idea for an improved product. Of those with ideas, most of these were small improvements (70.2%), but many were identified as potentially new products (29.8%). Approximately 15% of those reporting ideas had contacted manufacturers, and 3.3% eventually cooperated with them. Those users who identified potentially new products were more likely to take their ideas further, many had developed prototypes (41.2%) even tried to market their ideas on their own (29.4%) (Lüthje 2004).

It is often observed that the motivations for lead users to innovation are not primarily economic self gain (Lüthje 2004; von Hippel 2005; Hiennerth 2006). Instead, lead users choose to “freely reveal” their innovations whereby the innovator voluntarily gives up all intellectual property rights, information becomes public property (Harhoff, Henkel et al. 2003; von Hippel 2005). This is often accomplished through both real-life interactions and posting information to online communities.

Why then would lead users choose to seemingly violate their own economic self interest, and give their innovations away? The answers are diverse and difficult to measure. It is suggested that users may freely reveal to induce others to suggest improvements to their ideas, or reveal their own ideas in turn (Franke and Shah 2003; Füller, Jawecki et al. 2007). Others may enjoy reputational gains created from the sharing of their particular expertise. Some may feel that sharing ideas is part of the social norm of their community, and simply

enjoy participating in that way (Franke and Shah 2003; Lüthje, Herstatt et al. 2005). However, lead users are found to be less likely to freely reveal in more competitive communities (e.g. competitive snowboarding) (Franke and Shah 2003).

Examples of free revealing and knowledge sharing are evident in commercial settings as well. Motives here are usually driven by profitability. This situation is evident in the software industry, where it is often strategically advantageous to set industry standards. Customer adoption of a particular platform can be stimulated quickly by making it available for free. Using such methods, the overall market may be enlarged; creating opportunities for other products to generate profits (Allen (1983) as referenced by (Harhoff, Henkel et al. 2003).

The costs of protecting intellectual property may also be prohibitively large due to the complexity of licensing tasks. Corporate returns from licensing to are found to be generally low because protection is weak (Hill (1992) as cited by (Harhoff, Henkel et al. 2003).

Ideas generated from lead user techniques offer several advantages over more conventional survey and focus group methods of market study. Lilien describes a condition of “functional fixedness” experienced by most users of products, whereby familiarity with current conditions makes it difficult for consumers to envision things in a new way (Lilien, Morrison et al. 2002). Breakthrough product ideas are rarely obtained in this manner, since respondents are limited by their current experiences (von Hippel 1986; Lüthje and Herstatt 2004).

The ability of user innovators to create new products before manufacturers is based on their possession of “local” knowledge about their situation and condition (Lüthje, Herstatt et al. 2005). von Hippel describes this as “sticky information”, since it often remains localized due to the cost to transfer it to a remotely situated manufacturer (von

Hippel 2002). User innovators are able access this information more cheaply and make use of it, whereby manufacturers would have to incur cost to study and acquire it for themselves. This situation is often observed with industrial product innovations, where solutions are identified by customer firms at the point of use, rather than those firms who manufacture and supply those customers.

Harnessing the creative potential of lead users is a major source of innovation for manufactures who can identify and capture it (Urban and von Hippel 1988; Franke and Shah 2003; von Hippel 2005). User innovators are more able to supply products to undeveloped markets, where typical manufacturers cannot service since it is not profitable to do so (Hienerth 2006). User innovators usually finance their own early development, prototyping and testing efforts, which externalizes that cost from the manufacturer (Hienerth 2006). Many of the ideas generate by lead users have far reaching commercial attractiveness. Studies of electronics design software by Urban and von Hippel demonstrate that product innovations suggested by lead user clusters are readily accepted across larger groups of users with more diverse requirements (Urban and von Hippel 1988).

Herstatt and von Hippel (1992) use a study of Swiss machinery manufacturer Hilti to demonstrate that this methodology is faster (consuming only 56% of standard development time) and less expensive (consuming only 50% of conventional budget resources). Ideas generated from lead user techniques are often more profitable commercialization ventures. One comparative study finds products developed in this manner to be as much as eight times more profitable than those developed in other ways (Lilien, Morrison et al. 2002).

The lead user method for determining new product innovations has been successfully demonstrated by 3M corporation (von Hippel 1999; Lilien, Morrison et al. 2002), Hilti (Herstatt and von Hippel 1992), and National Instruments (Seybold 2006). Seybold chronicles the development of the Lego Mindstorms product line which was

developed in collaboration with National Instruments. An early decision was made by executives to encourage users to make their own improvements by “hacking” their existing products. The results of these activities were fed back into the official design activity, and triggered innovations which were incorporated into subsequent releases of the Lego Mindstorms product.

Lead users can prove to be an invaluable resource influencing the adoption and diffusion of new products into the marketplace (Urban and Von Hippel 1988; Morrison, Roberts et al. 2004). Lead users are often sources of innovation within their own communities, and their advice is sought by others. Their opinions can therefore influence the future behaviors of the larger community, since their knowledge often precedes even that of “early technology adopters” (Schreier, Oberhauser et al. 2007).

2.2.2. Integrating Customer Focused Design Principles

Successful product development efforts are based on a profound knowledge of customer needs, behaviours and values combined with a rich understanding of the marketplace and its potential competitors. While there is no prescription to suggest when this has been achieved, firms must decide for themselves when adequate time and resources have been allocated towards the acquisition of this knowledge.

Many businesses have adopted a Quality Function Deployment (QFD) methodology to aggregate the various elements of customer input, and formulate a design strategy which optimally addresses them. QFD techniques originated in Japan in 1972 and have been adopted by U.S. firms and throughout the world. QFD is a technique designed to be utilized by marketing and engineering groups to organize and prioritize customer needs in detail, and translate them into a the physical metrics which constitute a product specification (Griffin and Hauser 1993; Tontini 2007; Ulrich and Eppinger 2008).

The QFD methodology makes use of four graphical “houses” to present data (shown in Figure 2.2).

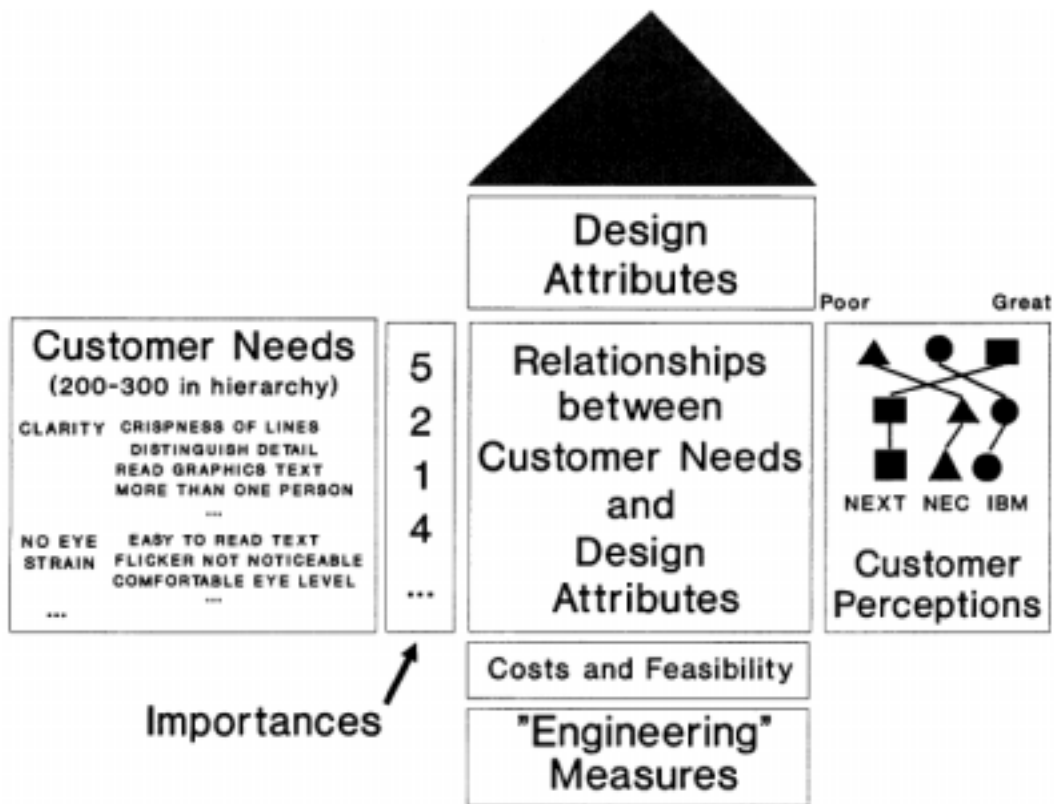


Figure 2.2 Quality Function Deployment Matrix
 Reproduced from (Griffin and Hauser 1993)

Griffin and Hauser (1993) provide a useful synopsis of this method which is highlighted below:

The first house (on the left) links customer needs to design attributes. This is often referred to as the “Voice of the Customer” (VoC). Griffin and Hauser (1993) suggest that a comprehensive list of customer needs may consist of 200-300 separate items. The list requires thoughtful analysis to implement a hierarchal structure resulting in 5-10 primary needs, as many as 20-30 secondary needs, and tertiary needs which provide engineering detail. A ranking scheme is also included to capture the importance or value which customers attach to each identified need. Consideration of this importance “weighting” supports decision-making where design “trade-offs” need to be considered.

An important caution in determining customer requirements is to focus on problems rather than the customer's own notions of solutions for their dissatisfaction (Ulwick 2002). Ulwick cautions that focusing on solutions too soon in the design process stifles creative thinking. Tontini (2007) identifies potential shortcomings of the QFD model which are based on three assumptions made by the model:

- 1) *customers have previous experience with the product being evaluated*
- 2) *they are capable of evaluating the importance and their satisfaction with the product requirement*
- 3) *the relationship between importance and satisfaction is linear and dependent*

These assumptions emphasise the customers understanding of what they have already experienced. Customers are not able to anticipate their delight with a feature that they have not even considered, and are thus not able to accurately attach value or importance to it. In this way, the QFD methodology may limit "breakthrough" innovations.

Tontini points to the Kano model of customer satisfaction (Figure 2.3) to illustrate the deeper complexities of customer satisfaction:

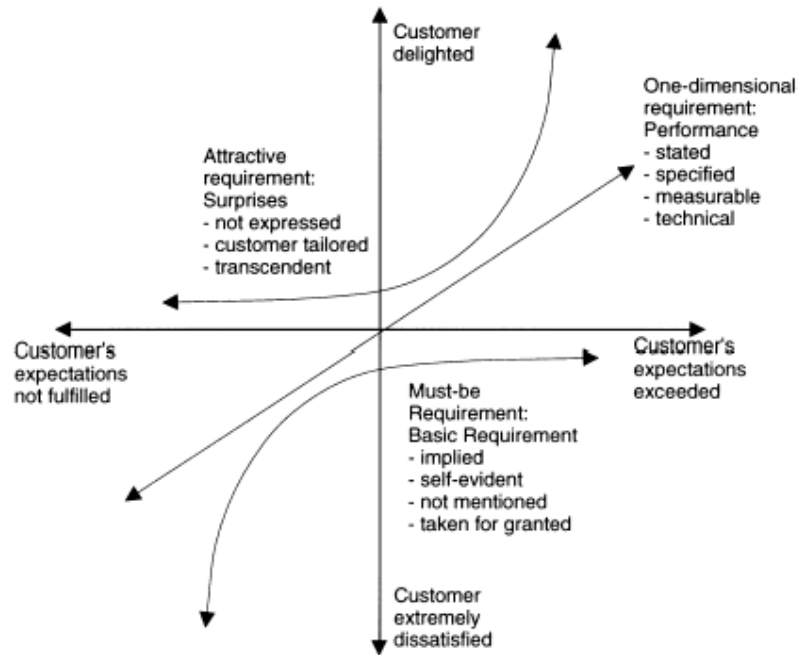


Figure 2.3 Kano's Model of Customer Satisfaction
 Reproduced From (Matzler and Hinterhuber 1998)

Kano's model suggests that customer satisfaction may have a non-linear and asymptotic nature, depending on the product requirement. One-dimensional requirements represent a linear response in customer satisfaction – more is better, less is worse. These are often well specified quantities; the fuel economy of a new vehicle for example. “Must-be” requirements typically receive less attention as they are deemed to be implicit in the design. Consider the example of power steering: a customer may not state its importance, as it is just taken for granted that a new vehicle will be so equipped. The customer experiences no additional pleasure from the fact that it appears as a feature on the new vehicle. However, if the feature is absent, the customer will be extremely disappointed. Attractive requirements are perhaps the most elusive. They are often not expressed by the customer, but may bring extreme delight when experienced. The unexpected feature of being able to connect a personal MP3 player to a vehicle's stereo system may be a novel and exciting feature for the

customer, especially if not anticipated at purchase. It should be noted here that customer's reactions to product requirements are variable with time and competition. A novel feature can not remain novel for ever, and may lose its appeal once it's discovered to be widespread amongst the competition.

As firms strive to adequately capture and make use of customer requirements, the market competition must also be considered. The QFD model incorporates this in the right "house" in Figure 2.2. Customers rank their perceptions of competitor's ability to meet the same set of identified needs. Highlighting the competitor's performance in different aspects allows the product developer to identify "white space" opportunities, where product attributes will exhibit favourably against competitors. By identifying some particular aspect (for example "ease of use") where the competitor is weak, the product developer can exploit this aspect to differentiate the new product from what is currently being offered. Cooper (1999) reports the positive results of "superior" differentiated products, enjoying higher success rates, greater market share and profitability.

3. Methodology

3.1. Research Methodology

The aim of this study is to develop and evaluate a framework to enable SMEs to incorporate customer focused design principles into their product definition phase. An additional goal of this study is to bridge the academic concepts of market research to the everyday requirements of practicing SMEs. A sizeable gap exists between academically accepted best practices and typical SME behaviour related to NPD.

Academic research seeks to isolate, identify and measure the effectiveness of individual research methods used to study customer behavior and attitudes. In reality, the results produced from such efforts provide a more complex mixture of results. This study seeks to make use of the framework with a real world case study to demonstrate how the results obtained from observing and interacting with customers can be related back to more formal academic practices. By identifying and highlighting those individual aspects found within the observations, the SME researcher is able to extract, categorize and exploit the results of his/her study to maximum benefit of the firm.

The study utilizes a Procedural Action Research (PAR) methodology (Platts 1993; Moultrie, Clarkson et al. 2007) to study through participative involvement in an NPD case study. The case study requires the participation of a small to medium sized New Zealand firm who is embarking on the development of a new-to-market consumer product. The participating company should have a recognised need for improvement of its market orientation, and be motivated to undertake efforts to do so.

A single case study will be used to evaluate the effectiveness of the framework. A single case study was chosen to allow a comprehensive evaluation from the concept proposal through to the prototype development stage. A functional prototype will be

produced at the culmination of this effort. The prototype will best demonstrate how market research data can be collected, interpreted and translated into physical traits.

The advantages of performing a single case study are realized in the researcher's ability to fully embed in a realistic product development effort. It is in this context that the SME's attitudes towards new product can be fully explored and observed. The framework can be evaluated in a realistic context, with its results scrutinized by the SME NPD team. The goal is to accurately simulate an actual SME research effort in as much detail as possible, to generate results which will be regarded as meaningful and relevant by the SME audience.

The results of a single case study may not be exactly repeated in other circumstances for different products and SME firms. While the framework is intended to be generalized to a wider SME audience, the particular details of how it is applied may vary. Depending on the specific product under study, different opportunities for studying customers may be presented. The key aspects of the framework are maintained, while the details of their execution may vary. Additional case studies would be useful to further the issue of generalization, but were not feasible within the stated time and scope constraints of this study. To address this limitation, the framework itself and case study results will be reviewed with an independent industry professional to solicit feedback and validate the broader generalization of the results.

3.2. Justification of Research Method

Achieving the goals of this study requires understanding customer focused design and research methods from the perspective of the SME who is actively carrying out NPD activities. The existing body of research surrounding NPD activity predominately focuses on identifying and quantifying critical success factors through survey methodologies. This

study seeks not to measure, but rather to increase the understanding of SME attitudes towards customer focused research, and identify those methods which will reap the most benefits for them. For this reason, the chosen method of study is a Participative Action Research (PAR) case study.

A typical survey based research project would involve the following activities: 1) develop a list of potential respondents from an industry association list or directory. 2) generate a series of survey questions and an associated response scale based on research hypothesis. 3) mail surveys and collect respondent information 4) tabulate responses and utilize statistical tools to support or contradict the original hypothesis. In the majority of NPD research, surveys usually seek to identify corporate behaviors exhibited by successful innovators and compare those with less successful firms.

While survey methodology is most commonly utilized for NPD research, this approach is found to be problematic for several reasons:

- 1) *There's no guarantee that surveys are completed thoughtfully or accurately* - Mass mailing or telephone type interviews rely on the interviewee honestly disclosing details of their internal operations. In the absence of a relationship with the interviewer, surveys may not be taken seriously or seen as a distraction. Interviewees may struggle in their objectivity when asked to put their own firm's shortcomings under the microscope. Surveys often experience low response rates. In a study of New Zealand export behaviour, Chetty chronicled feelings of "survey-fatigue" in her participants, some of whom had been surveyed as many as 10 times in the previous year (Chetty 1996).
- 2) *Surveys do not illuminate underlying behaviours* - Most studies involving the presentation of survey data require follow-up interviews to be able to assign meaning

to the quantitative values obtain. Often, the value of study is found in the insight acquired through direct conversation with participants.

- 3) *Survey questions may not adequate capture what SMEs are doing* - Specifically with SMEs, conventional survey designs often reflect larger business processes, and SMEs may not be able to adequately describe their informal processes within that framework (Gawith, Grigg et al. 2007). Even a soundly constructed questionnaire imposes a framework for response, which may not be suitable to capture the responses of a varied audience.
- 4) *Qualitative data implies a mechanistic cause and effect model* - The mechanistic model implies that if a certain set of causal factors are known and present, then predicted outcomes are likely to occur (Chetty 1996; Mariampolski 2002). While correlations of individual factors can be made with particular outcomes, such calculations are misleading as a predictive tool. In reality, a company's operations are far more complex. A company behaves as a result of a composite of interactions between individual employees. In effect, a company forms it own sort of "personality" similar to a person, with its own character, strengths, weaknesses, bias and idiosyncrasies.

In contrast, a case study methodology follows a much less controlled path with less predictable outcomes. Yin emphasizes three main attributes in his description of the case study methodology:

The distinguishing characteristic of the case study that it attempts to examine a) a contemporary phenomenon in its real-life context, especially when b) the boundaries between phenomenon and context are not clearly evident and c) in which multiple sources of evidence are used (Yin 1981).

Case studies can be employed to observe an individual firm's NPD activities in a more thorough fashion. A richer contextual understanding of events can be achieved through observation of a company's actions and behaviors. "Action research" techniques may be used in circumstances where the researcher wishes to influence the company's actions, and observe the results. In this situation, the researcher seeks to understand behaviors by becoming an active participant in the organization under study. Platts states:

'Action Research' takes participation one stage further. Here the researcher not only participates in the activity but seeks to direct and influence the way in which the activity is conducted. He imposes his conceptual frameworks on the tasks and interprets the events within these frameworks. He is not so much concerned with gaining a better understanding of current approaches to tasks as with changing those approaches and observing the effects (Platts 1993).

Here the researcher works in a less controlled setting, and must be more prepared to improvise and consider multiple sources of information as they are presented.

The outright benefits of a case study approach are also worth mention. A case study provides a more direct record of behaviors, rather than interpretations of constructed responses to surveys (Chetty 1996). Since the research takes place in a realistic setting, this approach maximizes the relevance of results to the industry that may most benefit from them (Platts 1993).

Case studies have been criticized as being uncontrolled and hence "quasi-scientific" investigations. The most common objection is that the findings provide little basis for scientific generalization (Chetty 1996). Information obtained through case study often is acquired from varied and incongruent sources. Research tends to be qualitative rather than quantitative in nature. This fact is troublesome to some observers since it makes it difficult to relate results to larger sample populations with any known certainty.

Yin argues in favor of the validity of the case study method as an attempt to explain a phenomenon. “It is a valid test of a theory, since within a particular case, the facts and events must fit the implications of the theory. Here an explanation of events is being tested, rather than the importance of a single factor” (Yin 1981). Montoya-Weiss and Calantone acknowledge the value of case studies to identify new concepts for further research (Montoya-Weiss and Calantone 1994).

Truly, there are merits to both methodologies and “research is best served by going back and forth between qualitative and quantitative research methods” (Platts 1993). For the purposes of this study, participative action research through case study will provide us with the most in-depth understanding within the SME context.

3.3. Criteria for the Case Study

A suitable case study is required to properly assess the effectiveness of the CFD framework. Candidate firms will be compared against the following requirements to determine their eligibility for the study:

- 1) The firm should be locally based in New Zealand to allow for frequent personal communications.
- 2) The firm should be a Small to Medium sized Enterprise (SME), according to the definitions cited in this study.
- 3) The NPD case study should be in its early stages of ideation, before a product specification has been established.
- 4) The firm should demonstrate openness and a willingness to participate.
- 5) The firm does not require pre-existing NPD procedures or need to have previous experience with NPD activity.

Any firm which meets these eligibility criteria would be considered a suitable candidate for the case study.

4. A Proposed Framework for Enhancing SME NPD through Customer Focused Design

4.1. A Proposed Framework for Acquiring Customer and Market Knowledge

Any firm, regardless of size, who wishes to undertake a customer focused design approach towards new product development must initially acquire a thorough knowledge of the markets in which they will participate, and the customers they seek to engage. A framework is presented here suggests means to for acquiring these insights, which have been specifically chosen to best reflect the specific challenges faced by SMEs. The framework will be subsequently used and evaluated in the new product development case study.

The framework explores two distinct, yet complimentary sets of knowledge required to successfully implement a customer focused design approach. Successful products are developed based on a sound knowledge of both markets and customers:

Market Knowledge: Knowledge of market conditions is necessary as the customer will naturally evaluate new product offerings by comparing them against existing alternatives. To empathize with the customer experience, a product developer must “see” their own product in the context of their competitors, as a customer inevitably does. A comprehensive survey identifies current and future competition, their products, competitive advantages and relative successes in the market. Analysis of this information can suggest if there is an opportunity or “white space” in the existing array of product offerings, into which a differentiated product may be introduced. Competitive products may be compared on axis of cost, quality and usability. For example, the product developer may look at a group of competitor offerings and question “does an opportunity exist in this product category for a higher quality version of a similar product?”. Product differentiation is a key strategy for success. Products

which do not achieve sufficient differentiation are often classified as “me-too” offerings and are typically not as successful (Cooper 2005).

Customer Knowledge: Profound customer knowledge is key to successfully implementing customer focused design principles. An in-depth study of customer’s lifestyles will allow the product developer to witness how products will be adopted and used by customers, and therefore enable them to design features to suit. A rich empathy of the customer experience can “tune” the developer in to features which are valued by consumers, but not yet available in current market offerings. Such features can only be thoughtfully contemplated when the developer acquires an understanding of customer values. Failing to recognize customer perceptions of value can sometimes lead to situations of “feature-creep”, whereby features are added in an attempt to differentiate the product, however the customer does not consider their added value.

The specific activities by which these two aspects are investigated are limited by the means and resources of the firms undertaking them. In this case, the framework was created from the perspective of the SME, with consideration given to the specific challenges and limitations they typical face during such efforts. The specific activities were chosen for this framework with consideration of three primary areas of constraint established from the literature:

Resource Utilization: SME product development efforts are constrained by the availability of funding for marketing and technical research (Freel 2000; Massey 2002; Allocca and Kessler 2006). Suggestions for customer and market research methods must recognize this, and require only a minimum of cost expenditure to complete.

Accessibility: Most SMEs acknowledge their own deficiencies in marketing skills (March-Chordà, Gunasekaran et al. 2002; Xueli, Soutar et al. 2002; Krake 2005). The suggested

methods must not rely on extensive marketing training or skill, but rather be implementable for researchers whose skill sets may be more technical in nature. The methods should be comfortable for the researcher, without requiring facilitation training or other advanced skills.

Speed: Reducing time to market is an essential component of success for SMEs (Owens 2007). It is necessary to identify methods which can produce results quickly to influence activities early in the product design process. SMEs face additional internal pressures to act swiftly and decisively due to their own tendency to be reactive rather than strategic (Enright 2001). Objective data must counter the influential roles of owners who might supplant drawn out decisions with their own instincts (McAdam, Reid et al. 2004; de Jong and Vermeulen 2006; Murphy and Ledwith 2007).

Cooper's study of product ideation methods (Cooper 2008) identifies several potential methods for acquiring customer information which are found to be successful by those using them. Methods such as ethnography, customer visits, lead user studies and focus groups are among the highest ranked activities. While these methods are based on highly prescribed procedures, aspects of these more formal methods can be achieved through less formal means. With consideration given to the specific characteristics of SMEs and the constraints they face, three specific research elements are chosen to increase market and customer knowledge, thereby enabling customer focused design activities to proceed:

1) *Online Search:* makes use of freely available internet resources to create a body of knowledge around the proposed product idea. Online resources offer a nearly limitless source of information describing customers, competitors and related ideas. Examples can be identified of customers demonstrating lead user behaviour. Kozinets (2002) argues that the communities of users who assemble themselves online are "real"

communities and observation of them is a valid method of ethnography study. Making use of this resource offers the advantages of being fast and cost effective. Through the internet, communities of users can be studied seamlessly across geographical boundaries. Online study offers the researcher the opportunity of actively engaging potential users with inquiries or ideas, or passively observing. The drawback of this method is perhaps the overabundance of information. A preliminary scan of available resources is beneficial to best select and limit the inquiry effort to a reasonable amount.

2) *Retailer Interview*: interviewing techniques allow the researcher to probe deeper into the meanings of initial observations. Direct inquiry with an interview subject allows the researcher to enhance the survey experience through the nuances of verbal communication and visual cues. Thoughts and feelings may be expressed more freely in a personal interview, in part due to a relationship established by the skilled interviewer. The interviewer is able to attach a richer understanding of wants, needs, concerns and values by observing the emotional cues of the interviewee. Interview techniques offer additional advantages over traditional survey techniques in that they do not strictly impose a structure to the interviewee's responses. The discussion can take a more free-flowing nature, following the lead of the interviewee where appropriate. The skill of the interviewer becomes more critical in this case, as the discussion needs to be subtly managed to achieve the desired outcomes. Many SMEs enjoy direct relationships with those agencies who are retailing their products directly to customers (Enright 2001) and can easily take advantage of these relationships. Retailers interact with many individual customers, and present an efficient means to survey a larger population of customers quickly. Underhill (1999) emphasizes the importance of studying the customer at the point of purchase, to better understand factors influencing buying decisions.

3) *Field Image Capture*: visual study of the customer in their native use environment is a powerful tool for increasing understanding. Images record details of customer activity which may not be immediately recognisable at the time of observation. A collection of images can be used to illuminate “zeitgeists”, or underlying themes of public behaviour (Coates 2002). Images are an effective method of communicating findings with others, and provide a focal point for group discussions around their meanings. Archived images represent an effective way to store evidence of research results, and lessen the dependence on conjecture. Observations of customers in their native environments inevitably force the product developer to confront his or her own preconceived notions about customers and their behaviours. The NPD process benefits through the confirmation or rejection of those previously held beliefs.

These results achieved from these research activities can be mapped to conventional academic literature. Information gathering, such as collecting photographs or reviewing online resources, will return a blended assortment of evidence described in academic literature. It is useful to identify and isolate elements of these concepts within the information acquired. A concept map is presented in Figure 4.1.

Benchmarking (Market Study)	Customer Knowledge	
	Ethnography Aspects (User Study)	Lead User Aspects (Solution Study)
	Online Search	
	Retailer Interview	
	Field Image Capture	

Figure 4.1 Concept Mapping

Cooper's StageGate process (refer Figure 1.1) was chosen as the backdrop into which the frame work would be applied. The framework fits conveniently into Stage 2 of Cooper's existing process. During this stage, marketing and customer information is collected and developed into a product specification.

Cooper's StageGate process was chosen primarily for its intense focus on early information gathering and structured decision making activities. SME literature identifies these activities as being characteristically deficient (Adams 1982), thereby offering the SME the greatest advantage by adopting them. The StageGate process offers the additional benefit of being intuitive, well known and well regarded. It is not a requirement that the SME completely adopt Cooper's methodology, however the literature suggests that incorporating some method of formal control is advantageous (Cooper 1998; Akgün, Lynn et al. 2004; Allocca and Kessler 2006; Larsen and Lewis 2007).

A suggested framework for acquiring customer and market knowledge is proposed in Figure 4.2.

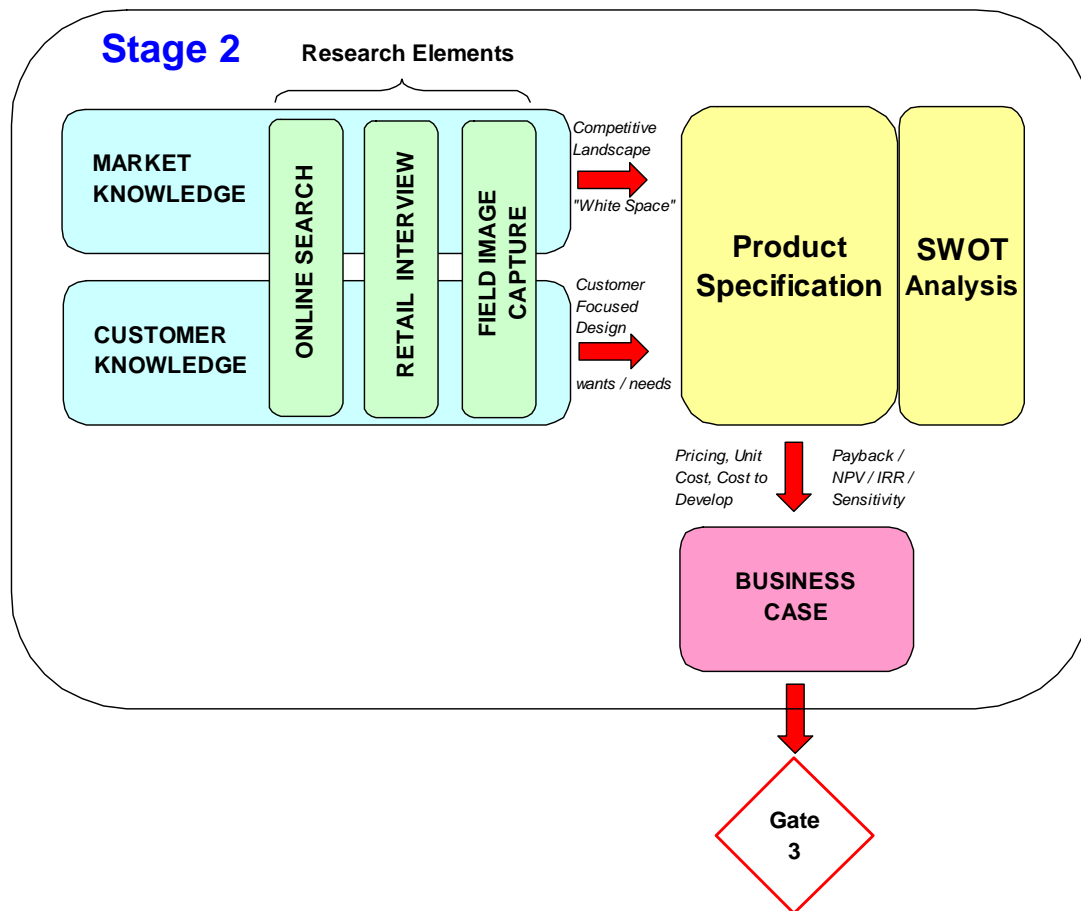


Figure 4.2 A Proposed Framework for Acquiring Customer and Market Knowledge

The culmination of the research efforts is the development of a product specification (Figure 4.2). The formulation of this specification is a dynamic and fluid effort as information needs to be considered simultaneously from multiple sources. Formal techniques such as Quality Function Deployment (QFD) (Griffin and Hauser 1993; Ashok, Jiju et al. 2006; Tontini 2007) are available to the firm who wishes a comprehensive methodology for assembling and ranking the information. These techniques will not be discussed here as they are less suited to the skill and resource limited SME. A Strengths, Weaknesses, Threats and Opportunities (SWOT) Matrix is included as an effective means to summarize the company's current market position. The matrix is assembled from

information obtained from competitive benchmarking, customer feedback and the company's self-assessment of their own strengths and weaknesses, which may not be visible to the external observer.

Cooper recommends the development of a product business case to be critically evaluated in the subsequent go/kill decision gate. In this manner, the development of a new product is treated with the similar discipline of any investment proposal. Calculations are performed based on suggested market pricing, sales estimates, production costs and development costs. These figures depend largely on external markets as well as the proposed product specification. Standard investment calculations such as IRR (internal rate of return), NPV (net present value of the investment) and investment payback periods are compared against company objectives, to determine if product development should proceed (Cooper 2005). Transparency in these calculations is essential, as it allows the firm to effectively manage its own financial risk. Proposals that do not succeed may be killed, or reconsidered with a different set of product features. The result may be an iterative process where product concepts are evaluated, reconsidered, and re-evaluated until the optimal solution is identified. Success here involves the right product "fit" in its intended market. "Fit" here describes the correct set of product features and attributes, sufficiently differentiated in the market, achieving the optimal value for the customer.

5. Customer Focused Design Case Study

5.1. Selection of the Case Study

A candidate company was interviewed to participate in this study. The candidate met the necessary requirements outlined in Section 3.3; being a medium sized New Zealand based enterprise with an active product development initiative. The company in this case approached the university seeking assistance in the development of a consumer product. Initial consultations took place to discuss expectations. The company's focus was on the generation of a novel product design for commercialization, while the research component would be able to examine the company's design practices during the design process and contribute to the development of the new product. The project was determined to be viable after identifying these complementary outcomes.

5.1.1. Company Overview

The subject company of the study is a manufacturing company based in Auckland, New Zealand. The company is privately held, with active participation by the owner. The subject employs approximately 70 people and would be considered a "medium sized" specialized manufacturing company, according to the New Zealand definitions employed here. The following is an excerpt from the company's website:

"The Auto Accessory Specialists" is New Zealand's market leader and an emerging key supplier in the Australasian market for the manufacture, import, export and distribution of an extensive range of quality automotive accessory products. Established in 1982 and employing over 70 full-time staff " " services the motor industry with Motor Company Approved Parts which are designed, manufactured and/or distributed from their 40,000 square foot facility and head office located in Auckland, New Zealand. " " success is largely based on and reflected by the companies 'Visions and Values'."

The company's original product lines consisted of aftermarket towbars used to accommodate the towing of trailers behind automobiles. The towbar consists of a rigid frame, which usually mounts directly to the chassis of the towing vehicle. A tongue or metal extension allows for the mounting of a tow ball, which provides a swivel mount for the corresponding trailer coupling. The interconnections are heavily standardized to facilitate the universal towing of different trailers, and highly regulated to ensure the safety of highway towing activities.

The company's initial business model consisted of selling towbar assemblies directly to private customers and professional installers. The company evolved and expanded to become New Zealand's predominant supplier of towbars to automotive original equipment manufacturers (OEMs) such as Holden, Ford and Nissan. The company enjoys a large percentage of the New Zealand market for OEM towing products.

In subsequent years, the company has expanded its product offerings to include a variety of external bolt-on accessories. These accessories are based on the light truck, utility or "utes" market. Products such as bull bars (mounted on the front or side to protect vehicle exterior), nudge bars (used for pushing other vehicles), rear decks, cabs, roof racks and vehicle-mounted bicycle carriers. In the company's current state, approximately 50% of the companies' revenue is generated from these aftermarket products, with 50% still derived from the original towbar business. The majority of sales take place in the New Zealand market, with approximately 30% of their revenue generated from exports to the Australian market.

The company's production capabilities consist of a combination of on-site fabrication and items purchased from suppliers. The manufacturing facilities include steel fabrication equipment such as cutting and welding tools. Much of this activity relies on manual operations, which are used for small production runs. Larger volume runs utilize

robotic cutting and welding equipment to automate the towbar assembly. The Auckland manufacturing site also houses finishing facilities, where towbar assemblies are chemically treated for corrosion, before receiving their final finish coatings. The factory runs on a build-to-order system, keeping the inventory of end-item goods to a minimum. Incoming goods are received just-in-time, with deliveries of raw materials arriving daily.

While some components used in fabrication are purchased from suppliers, in other cases entire fabricated assemblies are purchased and resold. In these cases, the role of the company is more of a distributor.

5.1.2. Current NPD Structure and Behaviour

The organizational structure of the company is constructed around its manufacturing activities. The majority of the company's employees are involved in manufacturing production including welders, machinists, surface finishing and material handling. Engineering support includes a team of new product engineers whom are attached to new towbar products which are being developed for production, as well as manufacturing engineers and a CAD technician. Management of the engineering activities is shared between two individuals, with the first assuming responsibility for towbar products, and the second engineering manager assuming product responsibility for all other non-towbar products, including bicycle carriers and vendor supplied items. The manufacturing site also houses the sales and support teams, as well as teams responsible for purchasing and logistics. Interaction between these groups is primarily achieved through informal face to face meetings. Manufacturing issues are addressed through scheduled weekly meetings which are attended by the entire management team, including the owner.

The organization can be described by two separate and distinct activity streams. The portion of the company that deals with the supply of towbars to automotive original

equipment manufacturers (OEMs) has a very rigid structure of design and validation activity for the development of new towbar products. The remaining portion of the company, which deals with much wider variety of automotive accessories, has a much less formal strategy.

NPD in the vehicle accessory market represents the greatest opportunity for growth in revenue and export opportunities. According to the CEO “...we have 95% market penetration in the towbar business. It’s difficult, expensive and not really worth going after that last 5%. New product development is the most important aspect of our business as it offers the greatest potential for growth of the company...” In defining the company’s role in the marketplace, he adds “Our niche is in higher end products and value-added engineering. We want to develop high quality and sophisticated designs which will draw a higher price, and offer a greater margin to us. We feel it’s important to ‘stick with what you know’, looking for product offerings that are logical extensions of our current capabilities.”

The company has a well established procedure for the development of new towbar products for new vehicles entering the NZ market. Automotive OEM customers are recognised to have tough quality standards for their suppliers (i.e. QS9000.) and their influence is readily observed in the company’s procedures. A product development engineer is assigned a particular vehicle platform and will follow that project to completion. A typical development cycle for a new towbar product is just 10–15 days, with an upwards of 30 new products in the pipeline at any given time.

The towbar design process begins by manually fitting a mock-up assembly of the towbar. Based on sketches of the mock-up, CAD models are produced and tooling fixtures are designed for the manufacturing facility. A tooling sample is produced and manufacturing feedback is solicited before final tooling is ordered. A first off tooling sample is then produced and tested hydraulically for static and dynamic loading. A final fitting of the tooling sample is mounted to the vehicle for approval by customer. The design process

ends with the customer final sign off on the product sample and the installation documentation that accompanies it. Bill of materials and time studies are evaluated to estimate the cost of production for the towbar. Final customer pricing is determined by sales manager, based on market conditions. The purchase agreements are dependent upon long-term relationships established with the customers, as no formal supply contracts exist with them.

The company's automotive accessory stream involves a much broader range of applications and product categories which present distinct challenges for NPD activity. Here, the company's NPD process is much less structured. The current product mix offered by the company includes a combination of in-house designs, custom products supplied by vendors, and mass customized products. The manufacturing strategy consists of primarily outsourced activity, with minimal in-house fabrication. The NPD team consists of only the Engineering Manager in a project manager role. The Engineering Manager is not solely dedicated to this task, and faces regular demands from production and supplier management obligations. Other internal expertise from engineering, sales and marketing departments are allocated as needed. The company makes use of external consultants where necessary for some engineering and industrial design requirements.

Typical NPD activity in this area involves identifying products from other geographical markets which might complement the existing range, and developing a supply chain for them. The Engineering Manager performs a supplier quality engineering role in this effort. New products are occasionally identified through observing trends in other markets and input gathered from suppliers and OEM customers. Projects are initiated by the CEO, based on input from sales and engineering departments, and are aligned with the strategic direction of the company. The process by which this input is incorporated into the new product strategy is informal and irregular. No formal procedures exist for the

collection of external data to support product design decisions. The decisions are rather based on the opinions of internal team members and “gut feel”. The typical product development cycle for accessories is not formally documented; however, its structure is described in Figure 5.1.

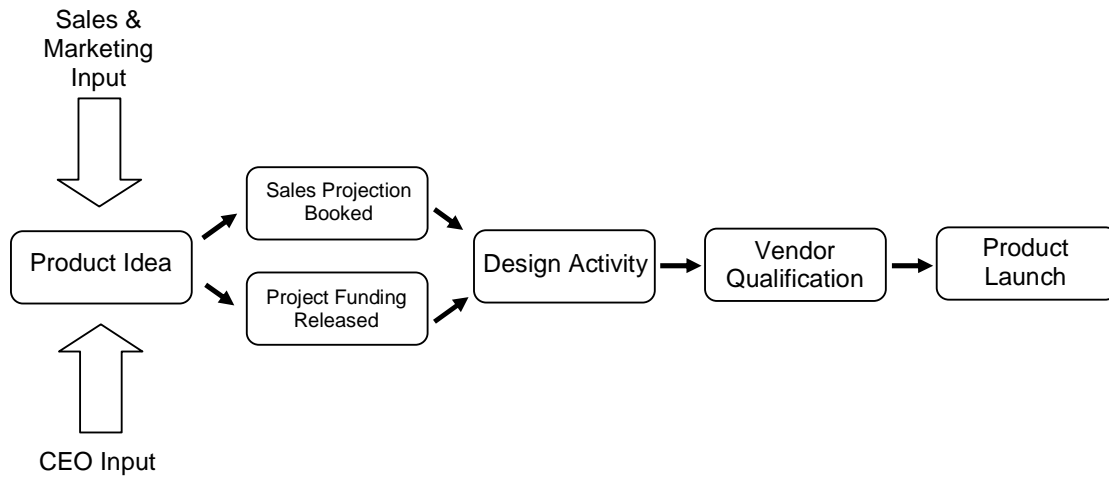


Figure 5.1 Informal Development Process for Aftermarket Products

NPD activity commences once funds have been allocated to proceed. The amount is based on an initial estimate from the engineering department. A sales forecast is quickly generated and booked based on the prediction of the sales department, which in turn creates timing deadlines for project.

Customer requirements are determined primarily through input from the sales department and consultation with an internal expert. Design activity involves the creation of detailed 3D CAD models of the overall product and its associated components. The design and CAD modeling is performed by the Engineering Manager in most cases, as he alone possesses the most experience with 3D modeling software tools. External contractors such as industrial designers and mechanical engineers are often utilized where skills are required. Once a design package is completed, it is sent to a vendor for prototyping. The design may

be further enhanced once the vendor samples are evaluated. The samples additionally provide a basis for evaluating vendor quality. Overall direction for the project is closely guided by the CEO.

The process demonstrated in Figure 5.1 was generated from direct observation of an informal design process. No formal documented structure exists for NPD activities related to the automotive accessory market. While a team approach is utilized, key decisions tend to remain with few individuals. It appears that an overall product strategy exists; however, it is not formally documented or readily shared with team members. Decisions surrounding individual designs are made without direct input or validation from the end customer; instead they are based on past experience, intuition and “gut feel”. The company is heavily dependent on suppliers and external contractors for inputs into design. Decisions are made quickly and strongly influenced by ‘expert’ opinion. This is most likely due to prevailing resource pressures. There is little time for in-depth analysis of market information and group discussions around its interpretation.

5.1.3. Product Focus: Vehicle Mounted Bicycle Carrier

Cycling is an increasingly popular recreational activity worldwide. While the usage of bicycles remains as a method of commuting and transportation, more people than ever are using bicycles in a purely recreational capacity. The evolution of bicycles has enriched the experience of the rider from simple utility, to a thrilling combination of fun and exercise. Bicycles have evolved from their basic forms into highly specialized areas including road, mountain bikes (MTB), and bicycle motocross (BMX).

One of the largest and still growing market segments in New Zealand is the mountain bike market. This segment includes enthusiasts who ride trails on bicycles with rugged frames, wheels and suspension components designed to survive intensive use, while

providing comfort and control. Innovation in materials and design have reduced weight, increased strength and added features such as adjustable full-suspension and disc brakes. As a result, the value of these products has increased dramatically. Expert-level mountain bikes can cost upwards of NZ\$8000 - \$9000, while the average enthusiast will purchase a model for between NZ\$1000 - \$4000. A wide array of aftermarket components are also available to upgrade and personalize one's bicycle after the initial purchase.



Figure 5.2 TREK mountain bike circa 1990



Figure 5.3 TREK "downhill" mountain bike circa 2008

The current popularity of this activity and expected market growth increases the demand for methods to transport bicycles from the home to the trails where the activity takes place.

The case study company currently offers a range of vehicle mounted bicycle carriers for recreational use. The most popular selling product in the existing range (shown in Figures 5.4 and 5.5) is a carrier which affixes to a vehicles towbar. Bicycles are mounted through an adjustable clamp mechanism that grasps the bicycle frame and snaps firmly closed.



Figure 5.4 EZI-GRIP II Towbar Mounted Bicycle Carrier



Figure 5.5 Towbar Mounted Bicycle Carrier with Bicycle Affixed

The original product (Figure 5.4) was released in 1994 and enjoyed strong sales and limited competition for its first 10 years in the marketplace. Some minor material changes were made to the original design to incorporate plastics with additional resistance to UV hardening. The original design faced increasing pressure to fit a wider variety of vehicles and a wider variety of bicycle frame sizes and geometries.

Numerous variations of the original product have been released in the years since its introduction. Variations include models with offsets to accommodate vehicle gates and hatchbacks, models that release to a folding position, and models that mount to European style towbars. Further products were added to the range to accommodate sport utility vehicles with spare tires mounted on the back, as well as carrier products which can be attached on vehicles that do not have towbars installed. Most styles of carriers offered are available in versions to carry 2, 3 or 4 bicycles. The firm now offers 34 versions of their carrier to customers, plus an additional 11 accessories which can be used to accommodate various bicycle types. The carriers are manufactured in New Zealand at the firm's site in Auckland.

Sales to customers are conducted through an established network of bicycle retailers. Most of these retailers cater to all categories of bicycle enthusiasts, including road and mountain bike riding patrons. The company does not distribute their products through large chain stores or through internet sales. The company supports this network of retailers

through its existing internal sales team. There is no external sales activity related to this product.

The product range is widely available and well recognized in New Zealand. There is currently very limited export activity for these products; however the desire of the company is to develop international markets for the product's replacement including Australia and North America.

The marketplace has changed substantially since the original product launch in 1994. Following the products initial success, the nature and form of bicycles has evolved to become less conducive to a clamp style mounting. The development of "downhill" style mountain bikes (see Figure 5.3) has led to radical changes in frame cross sections, which do not fit in the conventional clamp arrangement. At the same time, advances in materials technology have produced frames manufactured from carbon fibre, and other composite materials. While these materials have strong tensile strength, they are somewhat more brittle than traditional aluminium alloys. Customers who have frames constructed from these advanced materials have reservations about using clamps to mount their bicycles, as they may apply potential damaging shear stresses.

As the customer requirements of the product change, the market conditions have not remained unaffected either. Several competitors have entered the marketplace since 2004 and seriously eroded the company's market share. The two main rival competitors, referred to here as competitor A and B, share a similar design approach which differs to that of the company's original design. Both competitors utilize a cushioned two-prong design (shown in Figure 5.6) which can cradle the bicycle in a variety of positions. The two-prong design requires additional strapping of the bicycle to the carrier, and the straps are supplied with the product.



Figure 5.6 Competitor A's
Two Prong Design

The simplicity of this mounting approach allows it to be more universal in fitting bicycles with complex frame geometries, as well as children's bicycles which create mounting problems due to their small size.

Competitor A is a micro business located in New Zealand. Competitor A offers only two versions of the two-prong design: a 2 bike and a 3 bike version. These products are the sole offering by Competitor A, and retailers are actively supported by the company's energetic owner-operator. The products are competitively priced with those of the case study subject, and receive favourable reviews from the sale agents interviewed here. The carriers are manufactured domestically, similar to the subject's operation. While no precise data exists as to the relative proportions of market share between the case study subject and his rivals, one sales agent at a bicycle retailer stated he sells the competitor's product at a rate of "10 to 1" compared to the case study company. The general consensus at all dealers interviewed in this study is that Competitor A routinely outsells the case study company.

While Competitor B's product appears similar to Competitor A, it uses a very different model of distribution. Competitor B is also a New Zealand based SME, but uses the business model of an online distributor to distribute its wares. Competitor B offers a wide variety of discounted products for cycling enthusiasts, which can be ordered online and delivered directly to the customer from its warehouse. Competitor B uses no retail outlet other than its website. Its products are produced elsewhere, primarily in China, but sold

under their own brand. The bicycle carriers are considerably less expensive to the online shopper when compared those sold in bicycle retail stores. While there is no sales data to measure the success of this competitor, it is considered to be a formidable threat due to its aggressive pricing and the increasing trend of online purchases a wide range of accessories.

In response to the competitive landscape and the changing market conditions, the case study subject added a two-prong design to its product range. This action nearly coincided with the first appearance of Competitor A in the marketplace. However, this particular product offering has enjoyed less market success as evidenced by its lack of display at retailers, and observations of its usage at popular riding areas. Additionally, the subject suffered some negative criticism in online chatrooms, as they were accused of copying competitor's designs when releasing their own two-prong version. The subject denies this charge vigorously.

5.2. Application of the Customer Focused Design Framework

Application of the Customer Focused Design Framework required the definition of specific tasks identified by individual research elements. The tasks are performed individually, however their results can be considered compositely. Knowledge gained from one task often explains and elaborates observations made in another.

5.2.1. Online Search

YouTube was selected as the information source for the Online Search element of the product research. YouTube launched in February 2005 and has quickly become the internet's most popular video hosting site. The site is visited by 71.2 million users who post new video content at a staggering rate of ten content hours, for every real-time minute of its operation (www.youtube.com retrieved 2009). The site hosts a vast collection of streaming

video content on a diverse range of subjects. While initially finding popularity with creative individuals who produced content for fun and notoriety, it is becoming a more accepted forum for commercial activity.

YouTube was chosen as an information channel due for several reasons. Firstly, YouTube has been utilized as sales/customer support tool by many companies who choose to use this free video feed service to supply short “infomercials” about products, or to complement installation and operating manuals for their products. These videos often purposefully display detailed feature and design information about competitor’s products. Secondly, YouTube remains a popular vehicle for individuals and entrepreneurs to advertise their own innovations to an enormous audience of potential buyers. Finally, searching YouTube for a specific topic produces a window of relevant topics which are beneficial to the ideation process. Expected results for a typical product search include competitor products, homespun innovations and a variety of related topics which may lead to ideas for new adjacent products not previously considered. The video medium in itself is attractive since it provides powerful visual images and audio commentary which can be archived for later review.

The limitations of this method are largely related to the quantity of results obtained from the search engine. Searches for common keywords (such as “bicycle”) may produce tens of thousands of results or varying relevance. The algorithms used for indexing search results are not known; therefore, the researcher is left to experiment with different search terms and combinations of terms to provide a reasonable number of search results. The analysis should begin with a maximum target for the number of videos to review, based on time available. A simple run chart to track the relevance of search results (see Figure 5.7) can provide a easy guide to suggest when the efficacy of the review process has diminished.

YouTube does not facilitate direct contact to video posters. Software features do exist which allow video reviewers to post comments and submit videos themselves in response to postings. Many video posters do provide channels for contact, by posting a link to the website in the posting title, or displaying a link in the content of the video. Posters generally review the comments made on their video posts, and often reply to comments. Additional information about a product can be obtained in this way.

5.2.2. Retail Interview

The retail interview element of the product research was conducted through in-depth interviews with end item product vendors. Although first-hand interaction with customers seems the most straightforward method, studying customers indirectly through vendors has some particular advantages. It is worth mentioning here that in nearly all cases encountered, the vendors that were interviewed were also enthusiasts with first-hand product knowledge. Vendors provide the additional advantages of directly encountering many customers, in their pivotal role as a “gateway” between consumers and products. Accessing this knowledge base allows the product researcher to indirectly access many more customer experiences in a relatively short time. Vendors have the unique experience to be present and involved with the customer at the time when a purchase decision is made. Understanding the factors influencing the customer at this critical decision point is of paramount importance to the product developer, yet frequently overlooked.

Candidates for interviewing were chosen from a list of “boutique” bicycle shops which sell only bicycles, rather than large retailers who sell a variety of products. This selection was made since the sales personnel is typically more experienced, knowledgeable and will presumably provide more thoughtful responses to inquiries. In addition,

candidates selected were those who retailed the case study company's current product line as it was also beneficial to obtain some feedback on their own products.

5.2.3. Field Image Capture

A setting was identified to perform the Field Image Capture element of the study. In this case, a race meet was suggested as an opportunity to witness large numbers of customers who would be transporting their bicycles to the event. By selecting this setting for the field image capture activity, the product developer was able to witness a large collection of customers in a single location, in short duration. Due to the high intensity nature of the event, a passive observation of the subjects, rather than active interviews, was deemed appropriate. Photographing the participants in the context of their activity allowed the product to be observed during its actual use, while surrounded by the elements of the environment. The "look and feel" of the environment can also be captured in digital still photographs, which are critical considerations when determining the styling of a potential new product offering.

5.3. Results of Customer and Market Research Case Study

5.3.1. Online Search

YouTube was selected as the information source for the Online Search research element. Obtaining relevant data from this source was rapid and required minimal prerequisite skill.

The sites search engine was utilized to determine relevant results based on the single search term "bicycle rack". The choice of particular language for search terms can be somewhat problematic, and any specific search term will inevitably produce some degree of

unwanted results. In this case, “bicycle rack” may refer to a vehicle mounted carrier, a permanent structure for locking and storing bicycles, or a rack that is itself mounted to the bicycle for carrying baggage. Several distinct search terms were quickly screened based on a visual scan of the relevance of first page results. The search term “bicycle rack” was deemed to provide the largest quantity of most relevant results. This search term produced 1070 results which were sorted according to the search engines own “most relevant” index.

Data was collected from the YouTube website during a continuous period on 12/11/2008. Based on time limitations, only the top 250 results were then reviewed and coded into categories, manufacturers, and product lines. The videos were reviewed and categorized in subgroups of ten. Each video was quickly determined to be “relevant” to the search topic, or “not relevant”. Relevance was determined based on definition of videos containing bicycle carriers, or videos that could suggest adjacent product ideas which could possibly fit into the manufacturer’s current marketing and technology experience. A simple ratio of relevant vs. non-relevant topics was plotted such that the efficacy of the exercise could be monitored. The results are displayed in Figure 5.7.

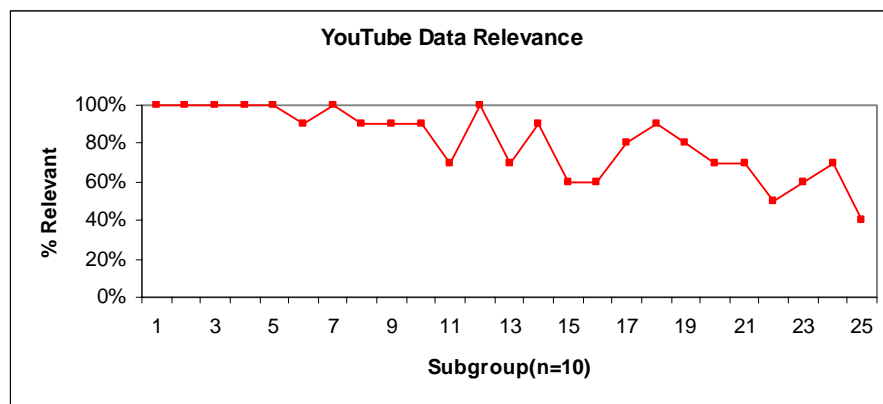


Figure 5.7 Relevance of Video Data Obtained from YouTube

From Figure 5.7, the decline of relevant information content can be observed with successive subgroups. This exercise validates the performance of YouTube’s relevancy ranking algorithm for research purposes. The quantity of videos to be reviewed remains a function of time available to the researcher, however terminating the review once the relevancy of returned results drops below 50% is recommended as a guideline.

An analysis of the videos obtained from the YouTube sample provided a wide variety of highly relevant video content. A list of categories was continuously developed and refined as the videos were reviewed. Table 5.1 displays the relative frequency of posts obtained from the data sample coded for categorical content. The majority of posts (57%) observed were from a small number of bicycle carrier distributors (not manufacturers) who post videos in an attempt to increase sales through demonstrating the features and usage of their product lines. These videos are highly effective when formulating a benchmarking study of the features currently offered by competitors.

Table 5.1 Categorical Results of YouTube Survey

	Category	Videos	% of Total	Description
1	carrier video review and demo	143	57%	Posts displaying features of various carriers, their installation and use
2	public bus carrier demo	15	6%	Bicycle carriers mounted to public buses
3	garage racking system	8	3%	Racking systems for storing bicycles at home
4	user innovation	7	3%	Independent inventors posting their bicycle carrier designs
5	lock video review and demo	6	2%	Posts which draw attention to locking mechanisms for bicycle carriers
6	outdoor racking	6	2	Racking systems for securing bicycles in public places
7	how to buy a carrier	5	2	Posts intended to educate consumers about carrier types and features
8	triathlon rack	3	1	Racking systems for use in competitive events such as triathlons
9	user study	3	1	General posts showing users loading their bikes
10	motorcycle carrier	2	1	Hitch mounted carriers designed to carry off-road motorcycles
11	other relevant	4	2	
12	not relevant	48	19%	Videos that are not related to the area of study
	Total	250		

The next largest category (11%) of interest is a composite group of videos which suggest ideas for adjacent innovations including public bus carriers (3%), home storage solutions (3%), outdoor racking (2%), motorcycle carriers (2%) and triathlon racks. While

the case study company currently does not produce any of these items, these innovations are appropriate for future consideration since they are logical applications of the company's current manufacturing capabilities and current market knowledge.

Approximately 3% of the videos posted were coded as user innovators and contained demonstrations of products that have been developed by individuals and micro businesses. Examples of more revolutionary innovations were observed in this category including different carrier mounting methodologies and a remarkable modular type design which can be adapted to carry golf bags as well as bicycles.

Approximately 19% of the initial survey group was comprised of videos that were deemed to be not relevant to the study. While substantial in quantity, few of these were identified in the low ranking results returned by the search engine. The review process became less efficient as the ranking increased, as unwanted results also increased in frequency. Most of the not relevant videos contained skateboard riders videoing themselves performing tricks on public bicycle racks.

The majority of results produced in this study were demonstrations of competitor's products. The sample produced a wide variety of different models (90) produced by a substantial group (26) of manufacturers. Manufacturers ranged from well known entities such as Yakima and Thule, to relatively unknown companies such as Softride and Amazing Racks. The majority of the models were not available in New Zealand, but rather in the U.S. and Europe. The results are summarized in Table 5.2.

Table 5.2 Manufacturer and Model Results from YouTube Survey

	Manufacturers	# of models	# of videos
1	Amazing Racks	1	1
2	Draw Tite	4	4
3	Highland	1	1
4	Hollywood	1	1
5	Kuat	2	5
6	MaxxRaxx	1	2
7	MiniLink	1	1
8	Mottez	1	1
9	OSI	1	1
10	Reese	1	1
11	Rocky Mounts	2	2
12	Rola	4	8
13	Saris	4	9
14	SGS	1	1
15	Siepa	1	1
16	SJS	1	1
17	SmartCar Performance	1	1
18	Softride	2	2
19	SportRack	11	16
20	Swagman	11	19
21	Thule	17	38
22	Titan	1	1
23	Topline	1	1
24	Tow Ready	1	1
25	Valley	2	3
26	Yakima	16	21

An in-depth study of the videos available from different sources identified several examples of attractive innovations related to carrier design. These examples highlight how innovation can be utilized to satisfy, surprise, delight customers and achieve product differentiation from their competitors. Innovations could be observed from all categories of videos including well known manufacturers, lesser known manufacturers and individuals who have independently developed projects. From this data, attractive attributes and features can be readily identified, and trigger ideas which may be directly incorporated or adapted to suit one's own design. Caution must be exercised to ensure that no patent or trademark protection prohibits one from "borrowing" clever ideas. A summary of key innovations identified in the data set are summarized in Table 5.3.

Table 5.3 Summary of Innovation Observations from YouTube Survey

Video	Observed Innovation
A	basic tilting design
B	aluminium construction, folding, tool-less attachment, rotating cradle, integrated locking cable
C	docking station for vehicle mounted carriers to be used for garage storage
D	design allows "extenders" to be added to base carrier to allow for additional bikes
E	simple, elegant mounting system for storing bicycles in a garage
F	carrier integrated into vehicle design, stored in compartment behind license plate
G	radical and artistic designs for locking bicycles in public spaces
H	vehicle mounted carrier that swings to the right to allow access to back of vehicle
I	anti-rattle feature
J	post carrier design that mounts behind license plate, rather than towball
K	V type design that grasps bicycle by wheels
L	novel design for transporting surfboards via bicycle
M	user innovation for adapting normal roof rack to carry larger tandem bicycle
N	user innovation where carrier is integrated into bicycle itself
O	basic carrier for hatchback mount without towball
P	user innovator mounts video camera on roof rack to observe sway during transit
Q	quick mount for European style towball
R	user innovator design
S	triathlon outdoor racking system for bicycles
T	Smart Car carrier with permanent mounting posts attached to vehicle frame
U	evaluation of bicycle carrier through various exercises on controlled vehicle test track
V	bicycle carrier mounted on public bus
W	Soft ride system with parallel system to lower bikes for trunk access and high end extruded shaft model
X	Cooper Mini carrier mounting with permanent mounting posts attached to vehicle frame
Y	User-innovator carrier system showing mounting of golf bag accessory

Several sample images obtained from the study of the YouTube archives are presented in Figures 5.8 – 5.11.



Figure 5.8 Typical Carrier Overview and Installation Video

Figure 5.8 demonstrates a typical carrier overview and installation video. The video is produced and posted by retailers who wish to educate potential purchasers of the various product ranges they carry. Distinguishing design characteristics are reviewed. Approximately 57% of the videos reviewed in the survey sample were of this nature.

Figure 5.9 is a video produced by the Kuat Innovations Company. This carrier displayed the most technical complexity of the reviewed products including aluminium construction, folding design, rotating and locking cradles. The most innovative and surprising feature was the integrated locking cable which is housed within the frame.



Figure 5.9 Innovative Features



Figure 5.10 User Innovations

Figure 5.10 is a video produced by an individual user-innovator. This product is unique from others since it utilizes an adapter plate which remains attached to the towbar. Various attachments can be snap-fit to this plate including a bike carrier or the golf bag carrier shown here. This concept is attractive and suggests peripheral product ideas which might be considered to expand the subject's range.

Figure 5.11 suggests potential new markets for the subject to consider. Recent volatility in world fuel prices and economic uncertainty may cause commuters to re-evaluate public transit options. Combining cycling with public transit is a means to deal with low density housing and bus routes. The market for this product has less competitors and predictably higher margins.



Figure 5.11 Adjacent Ideation

The study of the data obtained from the YouTube postings proved to be a valuable source of information. The data itself was very quick and easy to obtain, requiring only the patience and attention of the observer to identify and record information as it becomes evident.

The primary value of the study was the detailed demonstration of competitor's products, which could be used in benchmarking new product ideas. In the survey of 250 videos, over 90 unique bicycle carrier models product by 26 different manufacturers were available for review. Several key innovations from competing manufacturers were identified including aluminium materials, modular designs and integrated locking systems.

In addition to benchmarking data, YouTube proved to be a valuable source for observing lead user innovations, including those users who had developed their own bicycle carriers, or other tow ball mounted products. An unanticipated result was the suggestions for adjacent product ideas which could prove to be profitable future endeavours for the case study company.

5.3.2. Retail Interview

The retail study was performed over the course of two weeks in April 2008. Five vendors were chosen to represent the widest variety from specialty bicycle retailers section of the Auckland phonebook. The retailers chosen for the study reflected mountain bike and road bike products, exclusive and more economical product lines. The more economical retailers tended to have a larger selection of children's bicycles. The times of the visits were chosen to be in the middle of the day, such that the shops would not be too busy to answer some survey questions.

Upon arriving at a particular vendor, the sales personnel were asked if they would be willing to answer some questions related to bicycle carriers as part of a product study. In

some cases, inquiries were referred to another staff member with reportedly more product knowledge. The researcher's affiliation with the university and the case study company were fully disclosed at the onset of the meeting. The sales person was also assured that both the store and themselves personally would not be identified by name in the publication of the survey results. The mood of the interviews was kept light, in an effort to keep the salesperson relaxed and at ease.

The interview was guided through a short series of pointed survey questions designed to explore various aspects of the market condition and customer experience. The guide contained the following questions:

- 1) *How many competitive products do you sell in this category?* – This question is designed to assess what competitors currently exist in the marketplace, how are they priced and how do their relative sales volume compare with the manufacturer's current market offerings.
- 2) *What are the estimated annual sales forecasts for these products?* - Question #2 is useful to attempt to estimate the size of potential market for products of this category. Such figures are difficult to achieve by other means. Follow-up inquiries may inquire as to cyclic trends in sales behaviour?
- 3) *What categories of bicycles are you selling and in what relative frequency?* – Question #3 attempts to predict how bicycle carrier products will most likely be used by assessing the demographics of actual bicycles sold. Potential carrier designs will have to be optimized to best fit the most common bicycle frame geometry.
- 4) *What product features are most queried by prospective customers?* – Question #4 aims to gain insight as to what issues are most important to customers at the

time of purchase? Additionally, the salesperson's attitudes towards products may also be observed from their typical responses to such inquiries.

- 5) *What reservations do customers experience before purchasing?* – Question #5 is intended to identify gaps in the current range of product offerings in this category. Areas of dissatisfaction can be addressed in design to establish a competitive advantage over current product offerings.
- 6) *Are you aware of any product returns in this category, and for what reason?*– Question #6 also relates to customer dissatisfaction. In this case, the question attempts to identify issues experienced by current product users who have encountered quality issues with previously purchased products.

The survey itself was designed to focus, but not limit discussion to several key areas of inquiry. In all cases, the survey was used to initiate a dialog on bicycle carriers, and to re-focus the discussion where necessary. The survey questions were not intended for quantitative comparison, but rather to lead and facilitate a more free flowing discussion on the area of interest. Responses were recorded through manual notes. Actual responses from vendors were recorded exactly and appear in Appendix 7.1.

Upon completion of all of the interviews, conclusions were constructed from a review of common themes from the entire set of vendor responses to the verbal questionnaire. The conclusions are summarized below:

- 1) *Carrier purchase decision is highly dependent on sales agent* – the majority of customers purchase a carrier at the same time that they purchase a bicycle. While much consideration is made to the selection of the bicycle, the customer is less concerned with the secondary purchase of a carrier. In many cases, the customer will simply defer to the sales agent for their recommendation of which carrier to purchase.

- 2) *Price is significant factor, as carrier is secondary purchase after bicycle* – bicycles are expensive items are as such a well considered and emotional purchase for many buyers. The emotional investment does not extend to the bicycle carrier, which is an unfortunately necessary after-purchase. Customers often spend extra on their new bicycles, only to realize that they now have less to spend on the carrier.
- 3) *Fit of individual bike model is also very significant* – a suitable bicycle carrier must be able to carry a wide variety bicycles, or it is of little use. Cycling enthusiasts often own more than one bicycle themselves, each suited for different applications. Families require carriers that fit adult bikes as well as a variety of children's models, which are usually more difficult to fit. A carrier that does not fit any single member of a customer's fleet of bikes has little or no value to the customer.
- 4) *Secureness of bicycle mount is perceived as significant* – those customers who have spent thousands of dollars on a bicycle are especially concerned with the secureness of their investment while transporting it. Even those with less valuable bicycles are cautious of the potential dangerous situation of a bicycle coming loose on the motorway.
- 5) *Market is not generally dissatisfied with current offerings* – sales personnel failed to identify and substantive market opportunity for a new model of bicycle carrier. They were able to satisfy most customers with a prong type carrier, and there were very few customer complaints associated with them. There were no strong assertions when asked for potential improvements to existing products. Opportunities to add any features must do so without increasing price.

- 6) *EZI GRIP brand has some negative perceptions* – the general perception of the sales personnel interviewed was that the subject’s brand was the least recommended of the carriers they carried. The design was said to be “old” and problematic in terms of the kinds of bikes that fit it. “I sell 10 of the other for every 1 of those” was the comment from one more exclusive shop, “we only stock them in case somebody asks for it.”

The study of consumers at the point of retail offers many benefits when performed in conjunction with a similar study of consumers at the point of product use. Understanding the mindset of the customer specifically at the time and place where a purchase is about to be made is a distinct and essential part of product success. A well designed product which is poorly priced, poorly displayed or poorly explained will always struggle to be successful.

Specialty retail shops serve as focal points where many consumers of a particular product are funnelled in the process of acquiring such goods. A well-seasoned sales person encounters many of these customers and may summarize those experiences to a market researcher. This is obviously no substitute for firsthand experience with the target customer, yet the ease with which a researcher may survey large groups of experiences in a short time is valuable. In most cases, the sales persons interviewed provided thoughtful and concise answers to the questions posed. By conducting the interviews in person, additional information could be obtained through observation of body language and facial expression corresponding with comments. By conducting the interviews in the shop environment, products could be viewed and handled increase the effectiveness of communication.

As with any ethnography study, the formulation of summary comments is not a well defined process. Generating a summary of conclusions is rather highly dependent on the

researcher's ability to weigh all comments in the context which they were made, while combining visual cues, to produce a set of comments based on common themes.

5.3.3. Field Image Capture

The key to developing a successful product is to intimately understand the customer's experience with that product. In the case of new products, it is necessary to study the environments that the customers inhabit to observe their surroundings and behaviours. This has a marked advantage over simply "asking them what they want". Direct observation of the situation allows the researcher to observe opportunities of which the customer may not yet be aware. In the completion of this field study, a group of customers is observed in their native environment, in this case a competitive mountain bike event.

The event selected for the field study was the "Jamis 12 Hour" team mountain bike event held in Taupo, New Zealand on September 13th, 2008. The event was a 12 hour team endurance event, held in a wooded park near the town centre. The race attracted more than 1100 participants from the North Island, including men, women and children from ages 8 yrs old and up.

The study utilized photography to observe the event and identify characteristics of product usage. This passive approach was chosen to study this event as the charged competitive climate was not suitable for in-depth interviews with participants. Images were obtained in the early part of the day, as competitors were arriving and setting up for the race. During the event, images were collected from the parking lots and pit areas. No consent was sought from individuals, as none were identified in the study and most photographs consisted of equipment only. A sample of some of the images obtained from the

ethnographical study is presented with comments below. The images are grouped into four relevant categories: benchmarking, ethnography, lead users and adjacent product ideas.

Benchmarking: Figures 5.12 – 5.15 capture benchmarking of competitors products currently available in the marketplace.



Figure 5.12 More Expensive Rear Mounted Carrier

Figure 5.12 displays a more elaborate type of bicycle carrier available to the consumer. This carrier cradles and restrains the bicycle by its wheels. A vertical arm attaches to the frame to stabilize the bicycle during travel. Models such as this are not widely available in New Zealand; this was the only one of this nature observed at this event.

Figure 5.13 exhibits a cleverly designed carrier from an unknown competitor. This carrier is unique due to its folding ability. The carrier must be removed from the vehicle to provide access to the rear. This creates storage difficulties for carriers that do not fold. This carrier presents an elegant solution to the issue.



Figure 5.13 Unknown Manufacturer's Folding Carrier



Figure 5.14 Roof Mounted Bicycle Carrier

Figure 5.14 shows a roof mounted bicycle carrier. Roof mounted carriers provide easier access to the rear of the car and better protect the bicycle from road grime. The disadvantages require the consumer to lift the bike up to the roof of the car and steady it while the bicycle is affixed. Additional problems can arise due to issues of overhead clearance in garages and restaurant drive-thrus. A less common alternative to towbar mounted carriers. Only two of these were observed.

Figure 5.15 displays a new market entry from the subject's principal competitor. Updates to the product include a new colour scheme, and a new two part modular design. The prong support can be removed from the upright to allow the carrier to be stored in two separate pieces. This approach was taken instead of a folding mechanism. This was the only carrier of this model that was observed.



Figure 5.15 Competitor's
New Product
Entry

Ethnography: Figures 5.16 – 5.21 capture various aspects of product use experienced by a sample of customers.



Figure 5.16 Typical Usage of Pronged Carrier

Figure 5.16 displays typical mounting of a full suspension mountain bike on a prong type carrier. Here the user has utilized a rag to protect the bicycle frame from being scratched by the carrier.

Figure 5.17 demonstrates another typical user scenario. Here three mountain bikes have been mounted to a prong-type carrier.



Figure 5.17 Multiple Bicycle
Loading



Figure 5.18 Difficultly Experienced with
Multiple Mount

Figure 5.18 shows another multiple bicycle mounting. Here the user has made use of foam blocks to prevent the bicycles from damaging each other. The image clearly shows how the user has struggled to mount all three bicycles. The load appears somewhat unstable and several wheels are perilously close to contacting the roadway. This situation poses a danger to the driver and other motorists.

Figure 5.19 displays the difficulty of mounting a complex frame geometry of on a prong-type carrier. The front wheel of the bicycle hangs too low and is in danger of contacting the road. The front wheel is also positioned directly in front of the vehicles exhaust, which can lead to heat damage to the bicycles rubber tires.



Figure 5.19 Problematic Single Mount



Figure 5.20 Carrier Storage

Figure 5.20 details the usage of the carrier when it is not in use. This image highlights the cumbersome storage problem of the carrier when it is not affixed to the vehicle. Also evident here is the extender plate, required for the carrier to clear the rear mount tire, as well as the cable lock which this user has used to secure the carrier to the vehicle.

Figure 5.21 demonstrates the adoption of bicycle inner tubes as improvised tie down straps. The tubes make an inexpensive, reliable and effective restraint for the bicycle cargo, if appearing messy and untidy. The widespread availability of these tubes allows users to use as many as they desire to ensure the bicycles are rigidly mounted. This solution was observed on numerous vehicles at the event.



Figure 5.21 Inner Tube Securing Restraints

Lead User: Figures 5.22 – 5.24 demonstrate examples of customers whom have exhibited lead user behaviour by fabricating or modifying products for their own use.



Figure 5.22 Home Fabricated Towball Fitting

Figure 5.22 highlights a user innovation. Here the user has designed and manufactured their own carrier for personal use. The mounting mechanism is unique; the assembly slides underneath the towball. While not as elegant as commercially available products, this photo demonstrates how simply and economically a carrier can be fabricated using basic welding and cutting skills. New Zealanders enjoy a reputation for such skills and abilities.

Figure 5.23 demonstrates a common user innovation. The majority of users utilize bicycle inner tubes to hold their bicycles during transport. The tubes have high elasticity, good grip on the bicycle surface, and are incredible versatile in their use. Cycling enthusiasts would have many such discarded tubes, and have found this clever method to re-use them. This method was seen in use by approximately 60 - 80% of carriers witnessed at the event.



Figure 5.23 Inner Tube Securing Restraints



Figure 5.24 demonstrates another common user innovation. Approximately 80% of users with prong type carriers have modified their product through the addition of foam cushioning. Those enthusiasts transporting high value bicycles wish to protect the finish from scratching against the upright. Users employ a variety of scrounged materials including tape, pipe insulation and used bicycle tires.

Figure 5.24 User Added Cushioning

Adjacent Innovations: Figures 5.25 – 5.28 demonstrate examples of potential new products which fit with the manufacturer's current marketing and technology experiences.

Figure 5.25 shows a work stand which supports the bicycle while it is being serviced. This type of work stand is typically used by professional technicians in specialty shops; however there are few commercially available products in this category designed for home use. This appears to be a growing consumer product category and may be an opportunity for the case study company to extend their current product line.



Figure 5.25 Work Stand



Figure 5.26 demonstrates another adjacent product idea. Many competitors (25-30 teams) utilized these triathlon style racks to store their bicycles while waiting for the event. The racks display the bicycles, as in a showroom, and allow for easy access to them. All racks observed at this event were homemade, no commercial units were identified.

Figure 5.26 Triathlon Style Seat Rack

Figure 5.27 shows an alternative method for transporting bicycles on a trailer. The system utilizes a conventional towball mounted carrier, but an additional towball has been added to the trailer to facilitate its mounting. This image forces us to consider alternate mounting locations for existing products, other than at the rear of the vehicle.



Figure 5.27 Trailer Mounted Bicycle Carrier



Figure 5.28 Rear Wheel Stand

Figure 5.28 demonstrates a simple product used stand up a bicycle, rather than leaning it against a tree or car. Stands that are permanently mounted to the bicycle can be dangerous as they may dislodge during riding. This product demonstrates how simple adjacent products might be added to current product offering to increase sales, as well as presence at the retail outlet.

A brief summary of field observations is presented below:

- 1) *4 new adjacent product ideas that fit into the family* – adjacent innovations such as work stands (fig. 5.25), triathlon style racks (fig. 5.26), trailer mount hitches (fig. 5.27) and rear wheel stands (fig. 5.28) could be present opportunities for future product development.
- 2) *most vehicles were using the basic EZI-GRIP II model, including older models* – The case study company's current product offering is the most commonly observed type of carrier utilized, including older models, indicating their past sales success. Only straight versions of the carrier were observed; no variations such as bends or offsets were witnessed.

- 3) *only one sighting of principal competitors new product* – new product introduction from principal competitors offers some improvements over past designs. Only one of these products observed at the event (fig. 5.15).
- 4) *high incidence of competitor Q Spear, some Torpedo 7* – the case study company’s main rivals enjoy healthy market penetration. Larger quantities of EZI-GRIP II observed as a result of its longevity in the market
- 5) *majority of users have added extra padding to their carriers (>80%)* – most common user modification (fig. 5.24)
- 6) *majority of users utilize bicycle inner tubs as tie downs (60–80%)* – 2nd most common user modification (fig. 5.23)
- 7) *bicycles were pristine, appear unmodified (aftermarket equipment blended well)* – mountain bike enthusiasts typically purchase many aftermarket accessories for their bicycles, however observation finds that it blends in very well to the aesthetic of the equipment. Bicycles are very well kept, in pristine condition, indicating that enthusiasts attach value to the visual appearance of their equipment.
- 8) *carrier user implementations are lacking cosmetically* - the users sense of aesthetic regard for their bicycles does not extend to their bicycle carriers. Modifications to carriers appear very sloppy with little attention to visual detail. Even attractive cars supported “ugly” carriers (fig. 5.21).
- 9) *triathlon style seat rack systems were all homemade and of low quality* - this method of bicycle storage appears to be the accepted convention, however there appears to be no commercially available product in this category (fig. 5.26).

- 10) *no Thule rear mount* – Thule products are a recognized international market leader for bicycle carriers, but have little market penetration in New Zealand. No carriers of this type were seen.
- 11) *nice folding race design (who makes it?)* – provides example of an elegant folding mechanism. Manufacturer could not be identified until months later, when the product appeared in wide distribution (fig. 5.13).
- 12) *group is predominantly men 18 yrs – 45 yrs*

The photographic study proved to be a valuable exercise in acquiring information about the customer base. The data gathered could be collected into four categories:

- 1) *Benchmarking* – observed what kinds of carriers were being used and their relative frequency of use (Figures 5.12 – 5.15)
- 2) *Ethnography* – identified issues that customers were currently facing while using their bicycle carriers including mounting (Figures 5.16 - 5.19) and storing (Figure 5.20). Results establish a sense of how users assign value to the aesthetics of their bicycles, but not bicycle carriers (Figure 5.21).
- 3) *Lead User* – observed evidence of users who have developed their own products (Figure 5.22) or modified existing ones to better suit their purposes (Figure 5.23, 5.24)
- 4) *Adjacent Innovations* – observed product categories that the company previously had not explored, but would be logical extensions of their current brands (Figures 5.25 – 5.28).

The study of ethnographic information allows for a wide interpretation of the results. The benefit of collection of evidence through photographic record allowed for it to be reviewed several times, and reflected upon before constructing conclusions from it.

Additional benefit can be extracted from the images when reviewed in a group setting. Discussions surrounding the images allow for a more in-depth analysis, and a more meaningful interpretation.

5.4. Incorporation of Results into the Development of a Prototype

The pivotal exercise in the development of a new product, is to translate the acquired knowledge of customer wants and needs, both stated and unstated, into a product specification. The results from the previous data collection activities were aggregated to identify features of a new product specification. The most important aspects of the specification would be embodied in the production of a prototype.

Information obtained from the framework was collected and translated into a set of product features. Table 5.4 lists the specific product features uncovered by the case study research. The source of ideation for each feature is mapped back to its marketing research principle, and the framework element that produced it.

Table 5.4 Product Characteristics Derived from Customer Data

Product Feature Characteristic	Feature Description	Research Principle	Framework Element
Low Cost Market Entry	< \$200NZ retail price, vendor cost < \$100NZ	Benchmarking Ethnography	Retailer interview
Prong Type	Works for widest variety of road, mountain and kids bicycle types	Ethnography	Retailer interview Field Image Capture
Folding	Product differentiator – folding unit to permit small storage in vehicle or garage	Ethnography	Field Image Capture
Aluminium Construction	Product differentiator – lightest weight unit as compared to all NZ competitors	Benchmarking	Online Search
Tool Free Mounting	Key product differentiator – only carrier in the NZ market that requires no tools to mount to the towball. Mounts in seconds.	Benchmarking Ethnography	Retailer interview Field Image Capture Online Search
Revised Strapping	New strap design which mimics tube characteristics. Usage of inner tubes as restraints indicates some degree dissatisfaction with current strapping.	Lead User	Field Image Capture
Integrated Cushioning	Soft sleeve which incorporates branding	Lead User Ethnography	Field Image Capture
Locking Ability	Ability to secure carrier to vehicle and bicycle to carrier. NZ customers indicate minor concern over security of bicycles while parked. Larger concern in the US market, could migrate here.	Benchmarking Ethnography	Retailer interview Online Search
New Branding and Colour Strategy	Product differentiator - Adopt new colour scheme to appear lighter, less “agricultural”. Adopt new naming to reflect NZ culture and differentiate from previous EZI GRIP models.	Benchmarking Ethnography	Retailer interview Field Image Capture Online Search

Several initial concept sketches were created to visualize possible idea variations. Sketches were provided to the case study company for further discussion. Examples are shown below:

Figure 5.29 shows an initial concept sketch. This early sketch features a cam type lever mechanism to attach to the towball without using tools. The offset prongs were suggested to allow downhill mountain bikes with inclined frame members to be mounted horizontally on the vehicle. The prong design was abandoned, but the cam design was adopted for further development.



Figure 5.29 Concept Sketch A



Figure 5.30 shows another initial concept sketch. This concept sketch features a prong design with adjustable positions, allowing the customer to tailor fit the unit to match their bicycle frame. The design also features an extruded upright, giving it a distinct, more expensive look from conventional round tubing.

Figure 5.30 Concept Sketch B

Figure 5.31 represents the furthest departure from a conventional carrier design. This design features an extruded aluminium beam as an upright, providing a true contrast to other product offerings. The mounting mechanism used a shoe-type fitting to slide over the towball plate. The upright is tilted 5 degrees towards the rear of the car to keep bicycles from rubbing on the frame. This idea was rejected as well.



Figure 5.31 Concept Sketch C

A prototype carrier was constructed in the Massey University workshop in November 2008. The fabrication of the prototype is chronicled in Figures 5.32 – 5.34. A sample carrier was obtained from the case study company and modified to achieve the required product specifics. Not all aspects were chosen to be prototyped due to time and resource constraints.

Figure 5.32 shows some initial bench top fitting of the cam system. The initial single component cam was abandoned in favour of a two part assembly with brass plates contacting the towball.



Figure 5.32 Cam Development



Figure 5.33 demonstrates an early folding mechanism based on a minor modification to the original design. This mechanism was discarded in favour of a more aesthetically appealing design which allowed the carrier to fold into the minimum thickness envelope possible.

Figure 5.33 Initial Folding Assembly

Figure 5.34 shows the prototype carrier in a stage near completion. The folding pivot has been moved to intersect the tube diameter. The rotating fit of the assembly has been accurately machined to ensure smooth action during rotation. A spring loaded pin was added to retain the prongs in the folded or extended positions. The entire assembly has been fabricated out of steel to minimize material costs.



Figure 5.34 Prototype nearing Completion

The initial prototype was completed in December 2008. Figures 5.35 – 5.37 chronicle the prototypes first evaluation fitting onto a vehicle.

Figure 5.35 shows the completed prototype affixed to a vehicle. The key product attributes to be demonstrated here is the folding mechanism (here shown in its folded position) and the cam lever mounting mechanism. The product was named “Taupo” to identify its connection to New Zealand, and the strong mountain biking community there.



Figure 5.35 Completed Prototype



Figure 5.36 demonstrates a single bicycle loading on the prototype carrier. Here the folding mechanism is shown in its “open” position.

Figure 5.36 Single Bicycle Loading

Figure 5.37 demonstrates loading a single adult bicycle and a children’s size together. Note the difference in the sizes of frames. Children’s bicycles are more difficult to mount on carriers.



Figure 5.37 Double Bicycle Loading



Figure 5.38 demonstrates the addition of a padded wrap that displays the brand logo in large scale. A simple foam wrap was utilized for the demonstrating the prototype, however a colour matched pad would be use for production versions.

Figure 5.38 Foam Pad

The initial revision of the prototype carrier demonstrated the most critical differentiating product characteristics, namely the folding mechanism and the tool-free mounting system. The prototype successfully demonstrated proof-of-concept of these key innovations. Features that presented less risk to the design (material, straps, colourization, etc.) were omitted from the initial prototype for reasons of cost and timeliness.

A preliminary evaluation of the prototype was performed after its completion. The carrier was mounted and removed several times to identify any clearance issues. Several models of adult and children's bicycles were loaded to evaluate the fit. The loaded carrier was taken for an extended test drive to evaluate the reliability of the cam system. The prototype was reviewed by two enthusiasts who provided positive feedback on the features (one even asked to keep it!).

Several minor enhancements were identified with this first prototype: 1) the spring retention pin is difficult to pull. This could easily be resolved with the addition of a small T-handle. 2) The cam levers appear oversized, and should be smaller for aesthetic appeal. (During the evaluation, it was noted that users tended to use their feet to tighten the cams, rather than hands – this was an unforeseen development). 3) The carrier is heavy. Switching to aluminium construction would enhance the handling of the unit.

The construction of the 1st generation prototype was a quick and inexpensive means to evaluate the new innovation concepts. Following with a StageGate procedure, a second prototype should be fabricated which more closely resembles the final product design. A 2nd or 3rd generation prototype would be suitable for testing purposes and for a more in-depth review with customers.

5.5. Comparative Efficacy of Customer Research Methods

A comparison of the effectiveness of the individual customer research methods employed in the case study is presented in Table 5.5.

Table 5.5 Comparison of Customer Research Methods

Method	Advantages	Disadvantages
Online Search	<ul style="list-style-type: none"> • Minimal time expenditure • Inexpensive • Wide variety of information types • Access to international markets • Access to competitor descriptions 	<ul style="list-style-type: none"> • Too much information, requires selective filtering • Non-relevant information obtained from search terms
Retailer Interview	<ul style="list-style-type: none"> • Provides ability for follow-up inquiry • Setting of interview allows for more 	<ul style="list-style-type: none"> • Requires preparation • Requires some interviewing skills
Field Image Capture	<ul style="list-style-type: none"> • Captures product use environment • Captures non-recalled visual information • Can sample large numbers of users • Images provide basis for group interpretation 	<ul style="list-style-type: none"> • Requires travel to customer location

The results presented in Table 5.5 demonstrate the complimentary nature of the tasks outlined by the framework. All tasks met the objectives of being quick, inexpensive, and requiring little research skill.

5.6. Market Position Summary: Strengths, Weaknesses, Opportunities and Threats (SWOT)

An analysis of the case study company's current market position is presented here through the use of a Strengths, Weaknesses, Opportunities and Threats (SWOT) matrix. The SWOT analysis creates a snapshot which describes current external market conditions alongside the firm's own internal capabilities to meet them.

Table 5.6 Strengths, Opportunities, Weaknesses and Threats (SWOT)

<p>Strengths:</p> <ul style="list-style-type: none"> • In-House Fabrication Capability • Off-shoring Experience • Technical Depth • Reliability • Resource Availability • Product Enthusiasts • Available Distribution Channels 	<p>Weaknesses:</p> <ul style="list-style-type: none"> • Legacy of dated product in marketplace • Too many product variations • Branding • Industrial Design • Market Presence
<p>Opportunities:</p> <ul style="list-style-type: none"> • Re-Branding • Reduce end items • Market Specialization • New Zealand Identity • User-Centered Innovation 	<p>Threats:</p> <ul style="list-style-type: none"> • Competition: Q Spear – simple, universal design, grassroots market presence • Competition: Torpedo 7 – aggressive pricing, online sales channel • Competition: Thule – modern industrial design, global name recognition • User innovators • Low Cost Market Entries

The strengths of the organization are a direct result of their longevity. The company has established internal manufacturing capacity as well as established relationships with offshore subcontracting clients. Their experience as a first tier supplier of towbars to the automotive industry creates a disciplined approach towards quality and reliability, as required by their customers. Evidence of quality and reliability in their designs can be observed from the relatively few numbers of product returns, and the observation of older models of bicycle carrier products still in service. Additionally, automotive customers demand a disciplined NPD process which is rigidly followed in the development of towbar

products. While this structure is not as evident in the accessories part of the business, a successful product development framework does exist elsewhere in the company which provides a compelling example as to its value.

The company maintains a current product offering in the marketplace, while a replacement product is developed. The extended sales lifetime of the current bicycle carrier products has established robust distribution chains with New Zealand vendors. Future product offerings in this area will benefit from these existing sales channels.

The company is fortunate to have several bicycling enthusiasts who are employed in various functions. These individuals feel a personal stake in the reputation of the product, and are intrinsically motivated to see it successful. This factor is often identified as a characteristic of successful NPD projects (Lynn and Reilly 2002).

The principle weakness in market perception is the longevity of the product. The product has remained essentially unchanged for 14 years, during which time bicycles and bicycle accessories have both experienced revolutionary changes. The product itself is available only in black and appears heavy and somewhat “agricultural” in its design. Additionally, the product name and its associated graphics appear dated and give subtle clues as to the era of its original introduction.

A key aspect of vehicle mounted bicycle carriers is their ability to fit different types and quantities of bicycles and various vehicle configurations. The company’s response to this challenge has been to release multiple versions of the carrier, intended to fit the widest variation of vehicles. The result has been to create 34 end-items, compared to their leading competitor who maintains only two. This may seem to be a market advantage, despite the extra inventory carrying costs, but it is observed to create the difficulty of “too much choice” for the end-item customer. Vendors are unable to allocate sufficient floor space to

stock display all varieties and customers are required to choose and order from catalog images.

The current product offering elicited few positive comments from sales agents. In every case, the recommendation of the sales agent was in favor of a competitor's product. "We only stock them in case somebody wants one" stated one sales person "and that doesn't happen often".

Exciting opportunities for redesigning, rebranding and increasing the market share of the product are available to the company. New Zealand has an international reputation for outdoor adventure and extreme sports. These aspects would invite a New Zealand theme into the product branding scheme for export markets such as the U.S. or Europe. Additionally, such a theme would resonate strongly with the nationalistic spirit of the domestic market. While the technical advantages of the competitor's products are tangible, they are only incremental. In this case, further ethnographical study of the target customers may identify further opportunities to better position the product brand.

Partnerships with offshore manufacturing companies provide opportunities to reduce production costs for the product, which would also enhance market-share. While "Made in New Zealand" is an attractive concept, it is unclear whether this has a strong influence on purchase decision. "Designed in New Zealand" labeling may provide the same effect.

The principle threats come from competitors who have already eroded market share of the current product, and will continue to do so. The leading competitor (Competitor A) has displaced the case study company through a simpler, more universal design. Another prominent competitor (Competitor B) has benefited from discount pricing and its usage of the internet as its primary sales portal.

Further challenges exist from larger retail chains (i.e. The Warehouse, Repco, SuperCheap Auto) who offer bicycle carriers in addition to their bicycle or automotive

accessory lines. These large retailers pose direct threats to boutique-style bicycle retailers, as they are able to access similar products at lower costs. Negative economic conditions may encourage customers to seek the discounts associated with large retailers, and the smaller shops will see their sales volume eroded. Positive changes to the economy may encourage large retailers to extend their range to include higher quality bicycle products, which would have a similar effect.

Finally, the company faces threats from the end-item customer themselves. The relative low technology content of bicycle carrier products invites user-innovators to create their own products, if they are not satisfied with the current market offerings. These innovators will inevitably start their own businesses which in turn will become competitors. This is especially true in a country like New Zealand, where geographic isolation has fuelled generations of user-innovators who have been forced to develop their own creative solutions to problems.

6. Discussion

The knowledge gained in this study confirmed some previous findings, did not agree with others, and invoked some new ideas about SMEs attitudes towards new product development. Based on academic research, a framework of quick and effective techniques was developed which could be easily integrated into a SMEs existing product development activity and company culture. The framework was assessed through a real life case study of a consumer product under development by a New Zealand based SME. The market and customer knowledge obtained from the case study was interpreted and developed into a product specification. A physical prototype was fabricated to demonstrate the key aspects of that product specification.

6.1. Comparison of Results to SME Literature

The case study company faced similar financial constraints as experienced by many other small businesses (Freel 2000; Allocca and Kessler 2006; Kenny and Reedy 2006; Larsen and Lewis 2007), however to a lesser extent. The product development effort was adequately funded in this case, due to revenues generated from other parts of the business. The company employed a sensible approach to project funding by initiating the product development effort with a predefined budget. An increased sensitivity to cash flow was apparent, as the management team required sales projection estimates at the onset of the project (refer Figure 5.1), before any market or customer research was completed. The value of such an early projection was questionable.

As previously documented in other SME research (McAdam, Reid et al. 2004; de Jong and Vermeulen 2006; Murphy and Ledwith 2007), this organization was also strongly influenced by the owner/manager. During this study, the company owner participated directly in product development activities and had the final decision-making authority. The

owner controlled the direction of the product development effort, having strong opinions of what products the company should be offering to the public and how the brand should be managed. The opinions of the owner were presumably based on personal knowledge of the market combined with his own intuition; however, these ideas were not challenged or critically discussed by the team.

Previous studies of SME product development efforts identify a lack of marketing expertise within these smaller firms (March-Chordà, Gunasekaran et al. 2002; Xueli, Soutar et al. 2002; Krake 2005). The case study SME faced similar limitations. None of the participants in the company's product development team had formal product marketing experience. These skills may have existed elsewhere in the company, but they were not utilized during this effort.

The case study faced similar resource and time constraints identified in other academic studies (March-Chordà, Gunasekaran et al. 2002; Xueli, Soutar et al. 2002; Krake 2005). The project leader was often required to multi-task other roles including manufacturing support and supplier quality assurance. The situation was analogous to Filson and Lewis (2000) description of "fire-fighting" behaviour. The lack of focus brought inevitable delays to the project.

The case study company did not agree with the published literature in some areas. The SMEs ability to remain "close to the customer" is often cited as a competitive advantage over larger counterparts (Murphy and Ledwith 2007). However, during the case study this belief was observed to present more detrimental effects than positive ones. The underlying notion that "we know our customers" appeared to override objective market and customer research, and make it seem unnecessary. Hence the previous held ideas and intuitions of the owner and product development team remained unchecked and unconfirmed by objective data.

The case study company also displayed some attitudes and behaviours which were not present in the literature review. The company was very resistant to using a customer feedback after initial prototypes had been produced. When probed, the product development team explained their concerns of competitors copying ideas if they were presented to the public in any manner before an official product launch. Additionally, the team believed that any publicity prior to the official launch may erode the public's excitement towards the new product, and have a negative impact on sales. Hence their desire to operate in secrecy precluded any opportunity to market test potential product ideas.

6.2 Efficacy of the CFD Framework

The straightforward approaches to collect market and customer knowledge used in this study could be mapped to well recognized techniques such as lead user analysis (Franke, von Hippel et al. 2006), ethnography (Mariampolski 2002) and benchmarking. Results obtained from the framework reproduced some elements of these more formal methods of study, without requiring the full expenditure or skill requirements. In this streamlined manner, SMEs are more readily able to benefit from these techniques, while operating within their own limitations.

The framework utilized information freely available on the YouTube website. The categorization of information content available through this web portal is difficult to summarize. YouTube can be regarded in one sense as a commercial tool which can be used to advertise new potential products. Alternatively, YouTube can also be regarded as a communications tool, in which more in-depth information about products can be presented (i.e. video "user manuals" for products). These complimentary aspects of YouTube make it useful in the study of competitive products and their features. YouTube also contains a non-commercial aspect of user community. In this sense, ideas and innovations are freely

shared with fellow viewers who can comment and participate in discussions based on individual clips.

The case study employed two distinct means to study customers in their environments. The first technique used a conventional interviewing method to solicit information from the individuals responsible for the retail sales of the product. An ethnographical approach was used to interview salespersons in their working environments. The benefits of this method were obvious. The interviewees were comfortable in their surroundings and made use of visual cues to enhance their narratives. Interviewees often made references to physical examples as they described their experiences with customers. The interviewer gained the additional advantage of experiencing the environment in which purchasing decisions are made by the buying public. Valuable insight was gained into how products are displayed, how they are purchased, and how they might be compared and contrasted against competitors. Underhill (1999) stresses the importance of empathising with the customer at this critical decision-making moment.

The second means of studying customers in their native environment was through the collection of photographs at a race meet. Photography as a method of data recording is an effective means of documenting the natural activities of customers. The experience of the case study illuminated the value of images as a tool for communication, rather than memory recall or written descriptions of past events. The process of reviewing images encouraged interpretations from all team members. The review process provided an excellent opportunity to start a discussion whereby photographic evidence could be used to support or contradict previously held opinions about customers.

Evidence collected in the form of photographic and video content confirms that a sizeable portion of the public will either modify existing products, or develop their own products to satisfy unmet needs (Lüthje, Herstatt et al. 2005). Herstatt and von Hippel

(1992) suggest that this sort of activity is an indicator of lead user behaviour. The case study provided several examples such as users who produce their own bicycle carriers, or modify purchased products by adding their own straps and padding. The necessity of these modifications demonstrates unmet consumer wants and needs in the marketplace.

Published academic research considers ethnography and lead user analysis in separate contexts. Studies of these methods show how companies such as Honda may conduct purposeful ethnography approaches to better understand their target markets and design better suited products for them (Meyer 2008). Von Hippel (1999) identifies how companies such as 3M make use of lead user analysis techniques to design superior products.

The case study revealed that results were likely to be found to which included evidence of ethnography and lead user behaviour simultaneously within the same data set. By analysing the collection of images through these different lenses, additional knowledge could be interpreted from the data set that may otherwise go unnoticed. Similar results could be achieved through the observation of customers in person or online.

The framework was designed to optimally suit the character and constraints of SME new product development efforts. The techniques employed in the case study were suggested from the standpoint of the SME who may lack the resources or skills to complete more formal and comprehensive marketing studies. The elements of the framework were selected based on their accessibility to engineering staff that do not have formal marketing training. Additionally, the techniques were chosen to be swift and require minimal resources. The results produced from these methods were highly visual in nature, thus facilitating discussion and reflection by NPD team members. Images are evidentiary by their nature, and require discussion participants to confront their existing ideas and opinions.

6.3. Generalization of the Results

The framework and case study results were reviewed by an independent reviewer with relevant experience in SME new product development. The framework was judged to be sound and could be generalized to a wider group of SMEs carrying out similar NPD activities. The reviewers previous experience was predominantly business-to-business rather than business-to-customer, however many aspects of customer focused design remain common.

The nature of SMEs as described by the academic literature and directly observed through the case study was largely confirmed by the personal experiences of the reviewer. In the reviewer's estimation, SMEs are largely influenced by the ideas and opinions of the owner/manager. SMEs routinely fail to undertake adequate critical financial analysis in the early phases of development efforts, and risk spending precious resources on products that will not significantly contribute to the company's overall profitability. A meaningful financial analysis requires an accurate assessment of the market potential, and a realistic estimate of development and production costs. In the reviewers own words, "any amount of market research is better than nothing."

The reviewer stressed the importance of acquiring market and customer knowledge very early in the product development process, before resources are committed to ideas that may not be feasible. The entire product development effort may suffer if less than optimum ideas are permitted to linger for too long. Product champions make emotional investments in their ideas, as well as financial investments. As any project progresses, it becomes more difficult to shelve one's current ideas should a better one come along. This aspect highlights the requirement for a more objective decision-making apparatus to be available to SMEs.

Tasks to initially investigate ideas must be fast and require minimal resources. The reviewer favours the internet as a rapid means to investigate competitive markets and

research related trends. With only a few hours commitment, product ideas can be quickly tested for their viability. The internet is also used extensively to communicate with customers and collect information about problems they are encountering, and new trends and technologies which may be emerging (The customer base is international which makes visitations more difficult). The reviewer also makes use of trade shows as an opportunity to interact with customers and observe competitors in an efficient manner.

The retail interview portion of the research was highlighted as a valuable activity. The reviewer pointed out that successful products must not only be adopted by customers, but also by the retail outlets that will make them available to the public. Products must add value to the retail supply chain, which can also be considered a customer. Retail channels are often gated by key decision-makers, whose wants and needs must be addressed in a similar fashion to that of the ultimate customer.

The visual nature of the data collection schemes identified in the framework earned positive comments from the reviewer. Images effectively contain large amounts of information and can be easily shared and accessed. They are a more engaging way to learn about the customer's environments and experiences.

The framework also received positive feedback for its focus on adjacent product ideas which present themselves through the course of investigation of the primary product proposal. In the reviewer's opinion, SMEs often exclude potential opportunities by examining the market with too narrow a focus. SMEs need to broaden the categories in which they are able to provide products, as potentially lucrative product ideas may appear that are just outside the scope of the primary objective.

Based on the input of the reviewer, the framework was revisited to consider possibilities for enhancement. The suggestion to consider tradeshow as a forum for researching customers and competitors is a valuable one. This suggestion could be utilized

as an opportunity to perform retail interviews and obtain benchmarking data. In this manner, this activity fits within the existing framework structure, so no additional modifications were implemented to the framework.

6.4. Limitations of this Research and Suggestions for Future Study

The market and customer research techniques suggested by the framework provided comprehensive information to guide a customer focused design approach for the case study. The selection of YouTube as an information source provided relevant visual examples of competitive products, new product ideas, and lead user activity. Interviews with retail outlets allowed a focused survey of local customers and increased the awareness of the retail aspects of a successful product launch. Finally, the field image capture activity permitted the study of customer using products in their natural environments, revealing insight into how products will be used and modified by their end users.

The CFD framework was evaluated through a single case study. The customer and market research activities suggested by the framework yielded valuable information which could be implemented into a product design specification. By narrowing to one product development effort, the framework could be tested fully and the knowledge gained from the framework could be realized into a physical prototype. This action was intended to provide more relevant example of the framework being utilized to its ultimate completion. The CFD framework obtains information from multiple independent research elements. This aspect allows some validation of data within the framework itself (i.e. – a comment made by a retail salesperson may be validated through field observation).

Additional case studies would provide further validation of the CFD framework. Selection of additional case studies based on different product categories would allow the researcher to determine if the framework yielded comparative amounts of information for

those products. Case studies involving business-to-business applications and service based products would further explore the effectiveness of the framework.

The framework performed especially well in this case study. The bicycle carrier product was an established product and development effort was focused on improvements to the existing design, rather than a radically new product. Information regarding customer usage and competitive products was readily available as the general public had well established needs and wide exposure to competitive products. Depending on the level of innovativeness of the product development activity (new-to-world v.s. new-to-company v.s. improvement), the individual research elements suggested by the CFD framework may be more or less suitable. Table 6.1 suggests the suitability of the individual research elements, based on the level of innovation

Table 6.1 Suggested Suitability of Research Methods

		Research Element		
		Online Search	Retail Interview	Ethnography
Level of Innovation	New to World	Good	Good	Best
	New to Company	Best	Better	Better
	Improvement	Better	Best	Best

The ethnography element of the CFD framework is best suited to those more radical innovations (new-to-world) of which the general public has yet no awareness. This type of innovation is best studied by observing customers in their environment to identify needs of which they may not realize. New-to-company products are easily surveyed through use of online means, where a wide variety of existing competitive products may be observed and surveyed. Improvements to existing products are best discovered through interviews with

retail outlets (customer concerns and warranty issues) as well as ethnography methods where the actual (and sometimes unforeseen) product usage can be observed.

This study suggests the need for more focused research surrounding SMEs attitudes towards researching markets and customers. The existing SME research proved to be a effective predictor for the behaviours of the SME involved in this case study; however, the underlying reasons for these behaviours is not adequately understood. SMEs are generally thought to be “closer” to their customers, due to their size and frequent direct interactions with sales activities. The observations of this case study saw SME management “suppose” statements regarding customer wants and needs, rather than committing to objective research. While this study intends to remove some barriers to that research, the SMEs must still commit themselves to looking for answers outside their own walls.

The influence of the SME owner/manager in NPD decision-making was evident in the literature, and confirmed by the case study. SMEs could benefit from research into their decision-making structures (or indeed lack thereof). Success of the SME depends on the most advantageous decisions being made in every element of the firm. Further analysis of these decision-making structures, their effectiveness and means to improve them would benefit all firms.

This study made use of current internet technologies to find examples of competitive products, customer product usage, user-innovators, and adjacent product ideas. The knowledge gained from these activities is intended to be used to steer the design process as part a broader customer focus design effort. Similar internet technologies could be involved again later in the process, as a means to test and validate new product ideas. Peer networks such as YouTube, Facebook, Linked-In and Twitter could be utilized to establish networks of potential customers and consultants who are able provide nearly instantaneous feedback on specific questions, or to give feedback on design proposals. Additional research in this

are may discover an effective means to solicit customer feedback before design decisions are made, quickly and at a minimal cost.

6.5 Implementation of the CFD Framework

The CFD framework (Figure 7.1) was established to provide maximum benefit to SMEs undertaking new product development activities.

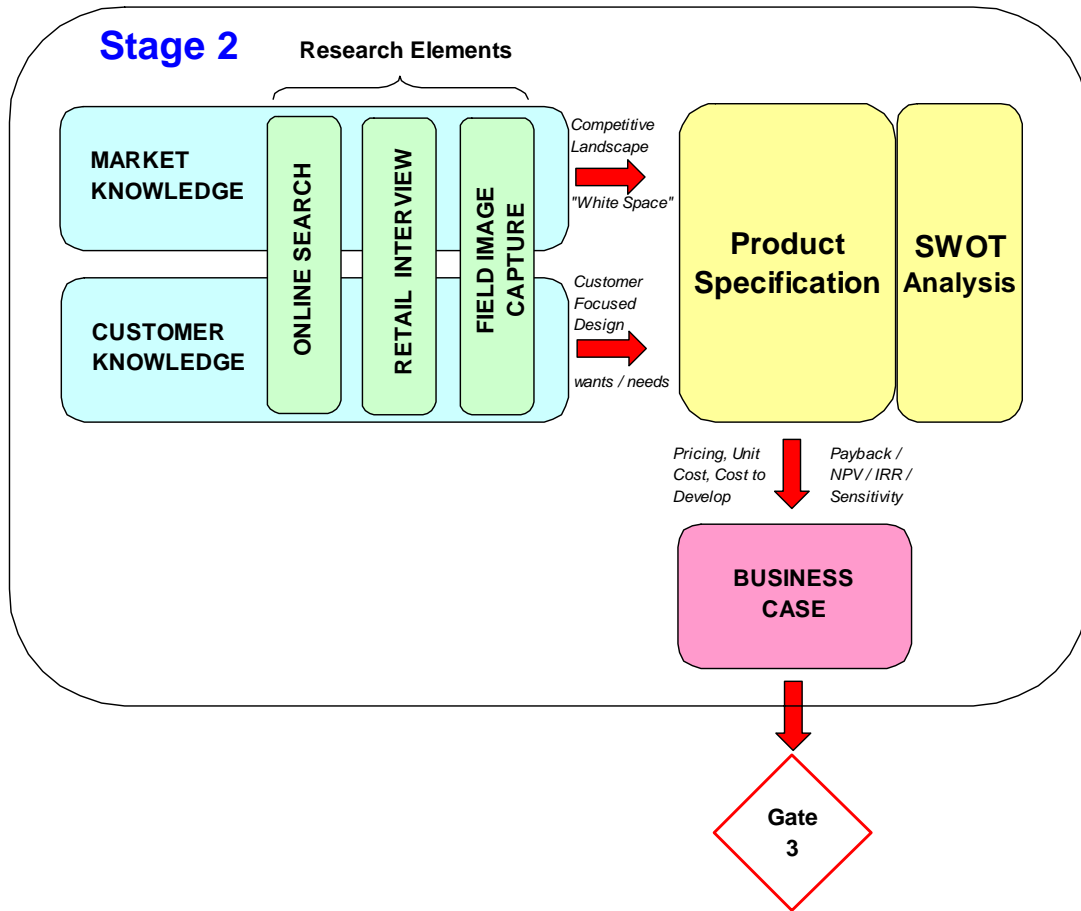


Figure 7.1 A Proposed Framework for Acquiring Customer and Market Knowledge

The CFD framework is intended to be used early in the product design process (shown here as Stage 2 of Cooper’s StageGate process as an illustrative example), after an initial concept for a product has been suggested, but important design decisions have not yet been made. The knowledge gained from the framework elements is used to guide the product design effort; in essence the customer focused design effort. Critical product design decisions may

already have too much momentum to be changed if they are not addressed early enough. Though recommended, it is not a requirement for the SME to have an established NPD process to take advantage of the CFD framework. The research elements outlined by the CFD framework should be maintained, but the specifics of how each element is performed remains at the discretion of the SME. The maximum benefit will be achieved if all elements are undertaken, such that the results can be discussed, compared and contrasted.

The CFD framework is suited to the constrained resources of the SME. The research elements suggested by it are intended to be carried out by individuals, or small teams. The elements would typically be carried out by the design engineer or product developer. It is advantageous for these individuals to be involved at the beginning, to establish an early focus on customer and market information, and encourage them to validate their opinions with external data as often as possible.

An important aspect of the CFD framework is that is performed by SMEs themselves, rather than as a service by outside parties. Knowledge holds more relevance and therefore value when it is earned through internal research efforts. Such knowledge is more likely to win the support of peers and management alike. A genuine CFD effort requires support of all players within the organization.

In situations where external support in the form of mentoring or training is required, industry associations such as the Product Development and Management Association (PDMA) and universities can provide a valuable support role for SMEs. Participation in these groups provides SMEs access to peer networks and facilitates an awareness of how firms in similar circumstances manage to address customer focused design. Additionally, these agencies can play a valuable role in providing more formal educational opportunities and therefore building long term capacity within SMEs.

A gated product development process is the recommended strategy for the implementation of the CFD framework. Customer and market knowledge gained from the research elements is used to formulate a product specification, which then can be estimated and analyzed to determine if the product is financially viable to proceed. It is preferable to use a functional team to generate the product specification, thereby utilizing different viewpoints to consider the results produced by the research elements. The visual component of the research results is especially beneficial to stimulate group discussion and evidentiary in nature, such it must be reckoned with in the face of prior assumptions. Such team exercises are often iterative, and require several meetings until all issues have been addressed, and there is more or less consensus on the process specification. The CFD framework is not prescriptive as to how such meetings should occur; it intentionally lacks formality as it is intended to mesh with the existing SME climate.

The CFD framework can be incorporated into the SME case studies' existing NPD process (refer to Figure 5.1, pg 71), though a more formal process and decision-making structure such as StageGate is recommended. Implementing the framework will inject a necessary customer focus into the initial product idea generation phase, thereby complimenting and reducing the dependence on internal knowledge from sales and the owner/manager. An initial investment of time and resource is required to complete the research elements identified by the framework; however, the investment will be rewarded with a better researched product that should ultimately prove more successful in the marketplace.

7. Conclusion

The completion of this study demonstrated how SMEs with limited marketing skills and resources can successfully acquire customer needs and market information and incorporate it into customer focused design technique. Two objectives were identified at the onset of this study and achieved:

- 1) *Develop a pilot framework to guide SMEs in the acquisition of knowledge to support customer focused design techniques.*
- 2) *Evaluate the framework through a product development case study.*

A framework was established by selecting those customer and market research tasks which best suited the culture and constraints of SMEs. The framework suggested in this study was successfully employed in a real life product development case study, and facilitated important insights into customer needs and values.

Three distinct research elements (Online Search, Retail Interview and Field Image Capture) were performed to acquire information about customer needs and market conditions. The research demonstrated how information from these readily accessible sources contained the basic elements of more formal market research tasks such as ethnography and lead user studies. Analyzing the data obtained from these three sources for these basic elements provided a more thorough and meaningful analysis. The synthesis of a product specification from these sources demonstrated how data can be contrasted and combined to form convincing statements about customer wants, needs and beliefs. The value of performing multiple activities based on different sources was clearly shown.

The project completed with the fabrication of a physical prototype which embodies the key aspects of the resulting product specification. The prototype's cam mounting feature demonstrates a key product differentiator identified from the market research that is yet to be exploited by any other manufacturer. During the course of this study, an

additional product line from a new competitor arrived in New Zealand retail chains. The new products boast a similar folding mechanism, therefore reducing the novelty and competitive advantage of the new prototype. The arrival of a new competitor negatively affects the potential market share for the case study SME. A revised analysis of the potential return on investment is required, now that the market has changed. This clearly demonstrates the importance of minimizing time to market, and the necessity of watching competitors closely to maintain advantage.

The SME which participated in the case study was welcoming and openly shared information about their corporate structure, previous projects, and strategic planning. Their cooperation was greatly appreciated and the information was an invaluable resource to this project. The management team of the case study SME demonstrated some resistance to the results of the customer and market research, especially in cases where the data challenged their own intuitions. The results may have been more readily accepted if they were not associated with an external researcher. This situation demonstrates the importance of building internal capacity for product development with SMEs, rather than outsourcing these important activities. Unfortunately, the SME was unable to continue its participation throughout the project due to other project commitments and day-to-day production demands. The study continued to completion in the absence of their participation.

The CFD framework developed in this study suggests straightforward and inexpensive actions which an SME may undertake to enable a customer focused design effort. The framework addresses previously perceived barriers to performing customer and market research, from the perspective of the SME. Successful implementation of the CFD framework requires a strong commitment on behalf of the SME to the ideal of customer focused design. Those firms which constantly learn from their customers, seek external

validation of their ideas and opinions and remain committed to acting on the results, are well positioned to develop superior products. Success in this effort requires a somewhat more reflective practice than that typically undertaken by the SME. The invariable time and resource pressures faced by small firms make such organizational behaviour a challenge. The case study clearly demonstrates that it is an achievable goal.

8. Appendices

8.1 Vendor Survey Data

Vendor Assessment #1 (completed 16/4/2008)

Vendor Contact Information:

Bike Barn New Lynn (Cara)
09 827 6951

Survey Questions:

1) How many competitive products (including case study) do you sell in this category?

EZI GRIP Range:

2 Bike Straight	\$149.99
3 Bike Straight	\$199.99
4 Bike Straight	\$279.99
2 Bike Offset	\$159.99
3 Bike Offset	\$209.99
4 Bike Offset	\$289.99
2 Bike 4x4	\$229.99
3 Bike 4x4	\$279.99
4 Bike 4x4	\$379.99
2 Bike Tilting	\$229.99
3 Bike Tilting	\$299.99
4 Bike Tilting	\$359.99

Bike Buddy \$60.00

Q-Spear Range:

2 Bike	\$199.99
3 Bike	\$249.99

Back of car version (Jack On) \$150, EZI GRIP \$140

"Q Spears are outselling EZI GRIP"

2) What are the estimated annual sales forecasts for these products?

- *Unsure*
- *Christmas is busiest season*

3) What categories of bicycles are you selling and in what relative frequency?

- *Kids bikes are the biggest seller*
- *Mountain bikes rank #2*

4) What product features are most queried by prospective customers?

- *Customers think" its lockable, due to appearance of clamps*
- *Customers perceive more secure*
- *Is it universal?*

5) What reservations do customers experience before purchasing?

- *"Will it fit my bike?"*

6) Are you aware of any product returns in this category, and for what reason?

- *Customer realize their bike does not fit.*
- *Broken screws, happens during vendor assembly. Hard to assemble.*
- *Recall one rust out*
- *Recall one plastics failure*

Observations and Additional Comments

- Bike Barn has 17 outlets across NZ
- Ordering is done through Mt. Roskill location (Ewan)
- Occasionally difficulty ordering (reasons unsure)
- Online shopping site growing popularity Torpedo 7

Vendor Assessment #2 (completed 16/4/2008)

Vendor Contact Information:

Avanti Plus, Henderson (Greg)
09 837 0680

Survey Questions:

- 1) **How many competitive products (including case study) do you sell in this category?**
 - EZI GRIP (display)
 - Q Spear (display)
 - Thule 970 Express (2 Bike) \$159.90, (3 Bike) \$299 – selling well. folds at hitch, able to lock to car, fits road bikes well
 - Sport Rack (Trunk) \$179.90 - no towbar
 - Q Spear tyre mount \$159.90
- 2) **What are the estimated annual sales forecasts for these products?**
 - Sell about 12 racks/ month
- 3) **What categories of bicycles are you selling and in what relative frequency?**
 - 50/50 mountain bike and road, higher end store
- 4) **What product features are most queried by prospective customers?**
 - Ask for sales recommendation, “and we all use Q Spear”
 - EZI GRIP appears more secure, customers will use it incorrectly and bikes will sway.
 - Looks like its lockable.
- 5) **What reservations do customers experience before purchasing?**
 - Kids bikes, triangle is too small,
 - clamp is too small for larger frames
 - won't fit full suspension
 - Do not want to put carbon fiber frames into an EZI GRIP
- 6) **Are you aware of any product returns in this category, and for what reason?**
 - Bolts on EZI GRIP are terrible, strip and break easily. We drill and replace with bolt
 - One bent Q spear – somebody tried to pull a boat with it.

Observations and Additional Comments

- “EZI GRIP” won't fit 90% of full suspension bikes
- “EZI GRIP Bandit – not long enough for 2/3 bikes, compared to Q Spear
- “like the 2 bolts on Q Spear – won't rotate
- “Only carry the EZI GRIP cause people sometimes asking for it, never recommend it”
- “Q Spear outsells EZI GRIP 10 :1”

Vendor Assessment #3 (completed 22/4/2008)

Vendor Contact Information:

Hedgehog Bicycles, Albany (Deb)
09 444 0644

Survey Questions:

- 1) How many competitive products (including case study) do you sell in this category?**
 - *Stock only Q-Spear (\$210 3 bike, \$240, 4 bike), EZ grip can be ordered, but only by customer request.*
- 2) What are the estimated annual sales forecasts for these products?**
 - *Sell approx. 2-3 units per week (Q Spear)*
- 3) What categories of bicycles are you selling and in what relative frequency?**
 - *50/50 kids bikes and adults*
 - *of adult models, 65% mountain, 35% road*
- 4) What product features are most queried by prospective customers?**
 - *little questioning, customer tends to follow lead from sales person*
 - *concern (will it fit my car?, will it fit my bike?), staff will demo product in the lot after sale.*
- 5) What reservations do customers experience before purchasing?**
 - *how sturdy will bungees be to attach the bikes?*
- 6) Are you aware of any product returns in this category, and for what reason?**
 - *Never any sale returns or warranty returns on these products.*

Observations and Additional Comments

- *"Children's bikes are difficult to fit due to the small triangle in frame*
- *"Concerns about damaging cables when mounting.*
- *"Simple, steady selling product, don't put too much thought into it.*
- *Limited feedback on EZ GRIP, since they don't stock it.*

Vendor Assessment #4 (completed 22/4/2008)

Vendor Contact Information:

Bike Albany, Albany (Simon)
09 443 2557

Survey Questions:

- 1) **How many competitive products (including case study) do you sell in this category?**
 - *Pacific Racks, 2 bike version. Plate bolts under ball – rack snaps in. cradle with Velcro strap. \$139*
 - *Thule products (none in stock), 2 bike \$159, 3 bike \$199, bike \$249 Thule folds up*
- 2) **What are the estimated annual sales forecasts for these products?**
 - *unknown*
- 3) **What categories of bicycles are you selling and in what relative frequency?**
 - *Primarily mountain bikes including some high end DH models.*
- 4) **What product features are most queried by prospective customers?**
 - *little inquiry, customers respond to sales lead.*
- 5) **What reservations do customers experience before purchasing?**
 - *can't think of any*
- 6) **Are you aware of any product returns in this category, and for what reason?**
 - *No*

Observations and Additional Comments

- *Road bikes – people tend to use more roof racks.*

Vendor Assessment #5 (completed 29/4/2008)

Vendor Contact Information:

R & R Sport, Ponsonby (Doug)
0800 777 767

Survey Questions:

1) How many competitive products (including case study) do you sell in this category?

- Thule "Hang-on" 972 \$319, tilts
- Thule Hang on 970 express, 2 bike \$149
- Q-Spear 3 \$199.95, Q-Spear 4, \$249.95
- Q Spear strap-on \$129.95
- no Yakima racks in NZ
- "trunk mount sales are through the roof"
- "6 years ago, ever car had a towbar, but japanese imports now arrive without one"
- "women like EZi Grip for its simplicity"

2) What are the estimated annual sales forecasts for these products?

- unknown

3) What categories of bicycles are you selling and in what relative frequency?

- primarily mountain bikes

4) What product features are most queried by prospective customers?

- priority is cost (rack is afterthought after bike purchase)
- ease of use, has to fit every bicycle, ideally no strapping.
- access to vehicle with rack on
- "theft is lesser issue in NZ, much more so in North America, not even racks from cars"

5) What reservations do customers experience before purchasing?

- Carbon frames, scared of damaging
- Alloy frames, also can dent – customer worry

6) Are you aware of any product returns in this category, and for what reason?

- Rack sold for wrong ball size (thule clamp)
- Weld failed on Q spear, foam wears out

Observations and Additional Comments

- Cycle city in Manakau is biggest road shop
- 40% of road bike purchasers are women
- Best to observe Woodhill Wed Night / Sat Morning
- Rear of car is dirty place to haul a bike, roof is best, but expensive (\$400) and risk of overhead damage
- Problems with bike buddy – bikes run too low, hot pavement. Also issue of exhaust melting tires (more than once)

8.2. YouTube Survey Data

Ran k	Not e	Title	posted by	Category	Manufactu rer	Model	Link
1		Yakima Copperhead Bike Rack Review Video & Demo - 8002064	orsracksdir ect	rack video review and demo	Yakima	Copperhea d	http://www.youtube.com/watch?v=RQ_yuFgDlsc
2		Thule 518 Echelon Bike Rack Review Video & Demo	orsracksdir ect	rack video review and demo	Thule	518 Echelon	http://www.youtube.com/watch?v=f7fQ3BhShzk
3		Yakima King Cobra Bike Rack Review Video & Demo - 8002084	orsracksdir ect	rack video review and demo	Yakima	King Cobra	http://www.youtube.com/watch?v=B8DQit3vdYDw
4		Thule 517 Peloton Bike Rack Review Video & Demonstration	orsracksdir ect	rack video review and demo	Thule	517 Pelton	http://www.youtube.com/watch?v=W1p0VcsMXnl
5		Yakima HighRoller Bike Rack Review Video & Demo - 8002091	orsracksdir ect	rack video review and demo	Yakima	HighRoller	http://www.youtube.com/watch?v=oXbk-uNWrp8
6		Rose View Transit Bike Rack Demonstration	waynetorg	public bus rack demo			http://www.youtube.com/watch?v=_Q3w1-r7Q1E
7		Swagman XP 5 Bike Folding Rack for 2 Hitches Review - etrailer.com	etrailertv	rack video review and demo	Swagman	XP5	http://www.youtube.com/watch?v=ZHmENAWs1Qw
8		Yakima SteelHead Bike Rack Review Video & Demo - 8002045	orsracksdir ect	rack video review and demo	Yakima	SteelHead	http://www.youtube.com/watch?v=0lZvtRPANM
9		SportRack 2 Bike Wheel Mount Rack Review - etrailer.com	etrailertv	rack video review and demo	SportRack	2 Bike Wheel Mount	http://www.youtube.com/watch?v=hUEmZdNtu0s
10		Thule XTR Big Mouth Single Bike Rack Review - etrailer.com	etrailertv	rack video review and demo	Thule	XTR	http://www.youtube.com/watch?v=VM7QPFLKRI
11		Draw-Tite 4 Bike Rack - etrailer.com	etrailertv	rack video review and demo	Draw Tite	4 Bike	http://www.youtube.com/watch?v=Z6LIT-JW0f0
12		Yakima SprocketRocket Bike Rack Review-Demo Video - 8002090	orsracksdir ect	rack video review and demo	Yakima	SprocketRo cket	http://www.youtube.com/watch?v=7ZZA9vs1CMQ
13		Yakima Viper Bike Rack Review Video & Demo - 8002000	orsracksdir ect	rack video review and demo	Yakima	Viper	http://www.youtube.com/watch?v=klr4YCzpc7s
14		SportRack Single Arm Hitch and Drive Deluxe Bike Rack Review - etrailer.com	etrailertv	rack video review and demo	SportRack	Hitch and Drive	http://www.youtube.com/watch?v=ShmpSXh4yQ
15		Swagman 2 Bike Wheel Mounted Bike Rack Review - etrailer.com	etrailertv	rack video review and demo	Swagman	2 Bike Wheel Mount	http://www.youtube.com/watch?v=i957qndatrK
16		SportRack Two Bike Wheel Mount Bike Rack - etrailer.com	etrailertv	rack video review and demo	SportRack	2 Bike Wheel Mount	http://www.youtube.com/watch?v=-EbcaoJjsto
17		Rola Triple X Folding 3 Bike Rack Review - etrailer.com	etrailertv	rack video review and demo	Rola	Triple X	http://www.youtube.com/watch?v=ihUOpdy6N1M
18		SportRack Escape 3 Bike Rack - etrailer.com	etrailertv	rack video review and demo	SportRack	Escape 3	http://www.youtube.com/watch?v=CwPw2fhOpJc
19		SportRack Hitch and Cable Bike Rack Lock Review - etrailer.com	etrailertv	lock video review and demo			http://www.youtube.com/watch?v=CWcv8AXGuRM
20		Swagman XP 5 Bike Folding Rack for 2 Hitches Review - etrailer.com	etrailertv	rack video review and demo	Swagman	XP5	http://www.youtube.com/watch?v=V4WjulnWfR0
21		Swagman 4 Bike Folding Wheel Mount Bike Rack Review - etrailer.com	etrailertv	rack video review and demo	Swagman	4 Bike Folding	http://www.youtube.com/watch?v=ZtQFjm0ZRVg
22		Rola Triple X Folding 3 Bike Rack Review - etrailer.com	etrailertv	rack video review and demo	Rola	Triple X	http://www.youtube.com/watch?v=ihUOpdy6N1M
23	A	Tow Ready Trailer Hitch Bike Rack - etrailer.com	etrailertv	lock video review and demo			http://www.youtube.com/watch?v=VAs30NfNcWw
24		Kuat Alpha Bike Rack Review - etrailer.com	etrailertv	rack video review and demo	Kuat	Alpha	http://www.youtube.com/watch?v=3pI0IghNfg
25		Draw-Tite Towing Bike Rack - etrailer.com	etrailertv	rack video review and demo	Draw Tite	Towing Bike Rack	http://www.youtube.com/watch?v=03RFjIDgkyk
26		SportRack Escape 3 Bike Rack - etrailer.com	etrailertv	rack video review and demo	SportRack	Escape 3	http://www.youtube.com/watch?v=CwPw2fhOpJc
27		Thule Roof Mounted Bike Rack Review - etrailer.com	etrailertv	rack video review and demo	Thule	Roof Mount	http://www.youtube.com/watch?v=IVKuaoyCGM0
28		SportRack Hitch and Cable Bike Rack Lock Review - etrailer.com	etrailertv	lock video review and demo			http://www.youtube.com/watch?v=CWcv8AXGuRM
29		Rola 2 Bike Rack - etrailer.com	etrailertv	rack video review and demo	Rola	2 Bike	http://www.youtube.com/watch?v=CWcv8AXGuRM
30		Thule Roadway 5 Bike Folding Bike Rack Review - etrailer.com	etrailertv	rack video review and demo	Thule	914 Roadway	http://www.youtube.com/watch?v=V1evT1ryvGQ
31		Swagman 2 Bike Wheel Mount Carrier Review - etrailer.com	etrailertv	rack video review and demo	Swagman	2 Bike Wheel Mount	http://www.youtube.com/watch?v=XL2Lbqtvs8
32		Swagman XT2 Bike Carrier Review - etrailer.com	etrailertv	rack video review and demo	Swagman	XT2	http://www.youtube.com/watch?v=GtqQAWmrYW8
33	B	Kuat 3 Bike Aluminum Folding Rack Review - etrailer.com	etrailertv	rack video review and demo	Kuat	Alpha	http://www.youtube.com/watch?v=kAluELhQ4jA
34		Tow Ready 3 Bike Carrier Review - etrailer.com	etrailertv	rack video review and demo	Tow Ready	3 Bike	http://www.youtube.com/watch?v=ya5g0Jn4vYU
35	C	Storage Pin for Thule and Yakima Bike Racks - etrailer.com	etrailertv	garage racking system			http://www.youtube.com/watch?v=AJGH4S2H1h0

36		Swagman XP 3 Bike Folding Rack for 1-1/4 Inch Hitch Review - etrailer.com	etrailertv	rack video review and demo	Swagman	XP3	http://www.youtube.com/watch?v=ADAY80KoiUM
37	D	Thule T2 Bike Add-On Bike Carrier Review - etrailer.com	etrailertv	rack video review and demo	Thule	T2	http://www.youtube.com/watch?v=6Lp3CB5VcdA
38		SportRack Hitch and Cable Bike Rack Lock Review - etrailer	etrailertv	lock video review and demo			http://www.youtube.com/watch?v=5Z4WWk4nkCo
39		Valley 3 Bike Carrier Review - etrailer.com	etrailertv	rack video review and demo	Valley	3 Bike Carrier	http://www.youtube.com/watch?v=rE3GJ6_HEI
40		Swagman XP 5 Bike Folding Rack for 2 Hitches Review - etrailer.com	etrailertv	rack video review and demo	Swagman	XP5	http://www.youtube.com/watch?v=V4WjInWFR0
41		Swagman 2 Bike Ball Mount Rack Review - etrailer.com	etrailertv	rack video review and demo	Swagman	2 Bike Ball Mount	http://www.youtube.com/watch?v=9CwoasdQqGE
42		SportRack Escape 4 Folding Bike Rack Review - etrailer.com	etrailertv	rack video review and demo	SportRack	Escape 4	http://www.youtube.com/watch?v=8VVdUnoUEIE
43		Swagman 2 Bike Wheel Mount Rack Review - etrailer.com	etrailertv	rack video review and demo	Swagman	2 Bike Wheel Mount	http://www.youtube.com/watch?v=SrokRRFUSnl
44	E	atomicRack - Cool Bicycle Rack	talbahir	garage racking system			http://www.youtube.com/watch?v=9nDYbJxjDY7g
45		atomicRack - Bicycle rack for garage	talbahir	garage racking system			http://www.youtube.com/watch?v=Mef9No-CA4E
46		Bike Racks on Buses	sfbikeorg	public bus rack demo			http://www.youtube.com/watch?v=IDIP3YPIcik
47		Storage Dock For Bike Rack Hitch Accessories - etrailer.com	etrailertv	garage racking system			http://www.youtube.com/watch?v=Sy4nj5MdZvk
48		Thule 990 DoubleTrack Hitch Mount Platform Bike Rack Review	orsracksdirect	rack video review and demo	Thule	990 DoubleTrack	http://www.youtube.com/watch?v=Va0I4RVXI-A
49	F	Vauxhall Corsa Bike Rack Demo	singletrackmag	other relevant			http://www.youtube.com/watch?v=VA4HaKthwcs
50		Thule Echelon Roof Mounted Bike Rack Review - etrailer.com	etrailertv	rack video review and demo	Thule	518 Echelon	http://www.youtube.com/watch?v=bj6juw8fnag
51		Yakima Raptor Aero & Raptor Bike Racks Review Video & Demo	orsracksdirect	rack video review and demo	Yakima	Raptor	http://www.youtube.com/watch?v=DT66NPoZU84
52	G	David Byrne's Bike Racks	WSJDigitalNetwork	outdoor racking			http://www.youtube.com/watch?v=brCk1-AVvRk
53	H	Yakima SwingDaddy Hitch Bike Rack Review-Demo Video 8002422	orsracksdirect	rack video review and demo	Yakima	SwingDaddy	http://www.youtube.com/watch?v=tI0u2cWRIUs
54		Revelation Cycling -- Bicycle Rack for Night Riding Video 3	mmichaelg	not relevant			http://www.youtube.com/watch?v=RvRTku55fRY
55		Thule Bed Rider Truck Bed Bike Rack - etrailer.com	etrailertv	rack video review and demo	Thule	Bed Rider	http://www.youtube.com/watch?v=JwTKvlePrnk
56	I	Kuat Aluminum Bike Rack	KuatRacks	rack video review and demo	Kuat	Beta	http://www.youtube.com/watch?v=IU7ForMCtu4
57		How to Buy a Bicycle & Accessories : How to Buy a Bike Rack for Your Car	eHow	how to buy a rack			http://www.youtube.com/watch?v=r3LluYVWZ9Q
58		Using the Bike Rack on a Public Bus	GPCOGvideo	public bus rack demo			http://www.youtube.com/watch?v=j2rQCvoBVjk
59		Swagman 3 Bike Carrier Review - etrailer.com	etrailertv	rack video review and demo	Swagman	3 Bike Carrier	http://www.youtube.com/watch?v=AMhJfA_EHo
60		Thule Revolver Swinging Bike Rack Review - etrailer.com	etrailertv	rack video review and demo	Thule	964 Revolver	http://www.youtube.com/watch?v=3RQk9FUyI7Q
61		Yakima FlipSide Hitch Bike Rack 8002426 Review Video & Demo	orsracksdirect	rack video review and demo	Yakima	FlipSide	http://www.youtube.com/watch?v=hxZZf5801Bs
62		Thule Double Track 2 Bike Rack Review - etrailer.com	etrailertv	rack video review and demo	Thule	990 DoubleTrack	http://www.youtube.com/watch?v=79qfdisqIFU
63	J	Amazing Bike Rack Installation Video	amazingbikerack	rack video review and demo	Amazing	not provided	http://www.youtube.com/watch?v=Z9A8vAemeE
64	K	Highland 2 Bike Rack Review - etrailer.com	etrailertv	rack video review and demo	Highland	2 Bike	http://www.youtube.com/watch?v=3JKYQqREE84
65		Reese 5 Bike Rack - etrailer.com	etrailertv	rack video review and demo	Reese	5 bike	http://www.youtube.com/watch?v=YHqBHEm_oSQ
66		SportRack Two Bike Wheel Mount Bike Rack - etrailer.com	etrailertv	rack video review and demo	SportRack	2 Bike Wheel Mount	http://www.youtube.com/watch?v=ziZReGirFOI
67		Rack Outfitters Reviews the Thule T2 Bike Hitch Rack	rackoutfitters	rack video review and demo	Thule	T2	http://www.youtube.com/watch?v=w2E-eE8yiGc
68		Swagman Camper Roof Mount Bike Rack Review - etrailer.com	etrailertv	rack video review and demo	Swagman	Camper Roof	http://www.youtube.com/watch?v=KRJ3i5IKHH4
69		Thule Insta-Gater Truck Bed Bike Rack - etrailer.com	etrailertv	rack video review and demo	Thule	501 Insta-Gater	http://www.youtube.com/watch?v=yUo9DENWnOQ
70		Draw Tite 3 Bike Folding and Towing Carrier Review - etrailer.com	etrailertv	rack video review and demo	Draw Tite	3 Bike Folding	http://www.youtube.com/watch?v=kqWOBnca4WI
71		SportRack Frontier Spare Tire Mount Bike Rack - etrailer.com	etrailertv	rack video review and demo	SportRack	Frontier	http://www.youtube.com/watch?v=9TPlovXkPyw
72		TARC Bike Rack Rap	ridetarc	public bus rack demo			http://www.youtube.com/watch?v=eoFFg0W9UME

73		Thule Roadway Folding 4 Bike Rack Review - etrailer.com	etrailertv	rack video review and demo	Thule	914 Roadway	http://www.youtube.com/watch?v=iCjJPF6Fgm4
74		Swagman Upright Roof Mounted Bike Rack Review - etrailer.com	etrailertv	rack video review and demo	Swagman	Upright Roof	http://www.youtube.com/watch?v=rfpyyVP4ne4
75		Draw-Tite Wheel Mount Trailer Hitch Bike Rack - etrailer.com	etrailertv	rack video review and demo	Draw Tite	Wheel Mount	http://www.youtube.com/watch?v=yVmK-mDNw4o
76		Bike Rack Bike Swap & Show Spring 2007	degallina1	not relevant			http://www.youtube.com/watch?v=yblNxnjYh5c
77		Rack Outfitters Reviews the Yakima Viper	rackoutfitters	rack video review and demo	Yakima	Viper	http://www.youtube.com/watch?v=dV76lwOPmOs
78		Thule 954 - Ridgeline Demonstrated by Rack Outfitters	rackoutfitters	rack video review and demo	Thule	954 Ridgeline	http://www.youtube.com/watch?v=18QOeqiw8cM
79		SportRack Towing 4 Bike Rack Review - etrailer.com	etrailertv	rack video review and demo	SportRack	Towing 4	http://www.youtube.com/watch?v=x2pKwPSYAEI
80		Thule 964 - Revolver Demonstrated by Rack Outfitters	rackoutfitters	rack video review and demo	Thule	964 Revolver	http://www.youtube.com/watch?v=_ToPysF74U8
81		Thule 964 Revolver Hitch Bike Rack Review Video & Review	orsracksdirect	rack video review and demo	Thule	964 Revolver	http://www.youtube.com/watch?v=r7DcNVQx19Q
82		How to Buy a Bicycle & Accessories : How to Mount a Rear Rack on a Bike	eHow	not relevant			http://www.youtube.com/watch?v=A2H73FPryFY
83		OSI Swinging Trailer Hitch Mounted Bike Rack - etrailer.com	etrailertv	rack video review and demo	OSI	not provided	http://www.youtube.com/watch?v=gGo7zwxPFRg
84		Thule Roadway 4 Bike Folding Carrier Review - etrailer.com	etrailertv	rack video review and demo	Thule	914 Roadway	http://www.youtube.com/watch?v=ZKkHeNvHlsw
85		Thule Ridgeline 4 Bike Rack Review - etrailer.com	etrailertv	rack video review and demo	Thule	954 Ridgeline	http://www.youtube.com/watch?v=kd56-7aJDw8
86	L	ACG Surfracks - bicycle surf rack system - save gas money!	scumline	other relevant			http://www.youtube.com/watch?v=ndJ40D8dXyS
87		Thule Speedway Demonstrated by Rack Outfitters	rackoutfitters	rack video review and demo	Thule	961 Speedway	http://www.youtube.com/watch?v=pdGVikpEeGU
88		bicycle carrier	pierremcourse	rack video review and demo	Siepa	Fix&Go	http://www.youtube.com/watch?v=4kGdCEzaUYQ
89	M	Homemade Tandem Bike Roof Rack Adapter	speede541	user innovation			http://www.youtube.com/watch?v=ZYOTPrh5B8
90		Thule Roadway Series Demonstrated by Rack Outfitters	rackoutfitters	rack video review and demo	Thule	914 Roadway	http://www.youtube.com/watch?v=sEDwGKcGpCM
91		Thule Roadway 2 Bike Carrier Review - etrailer.com	etrailertv	rack video review and demo	Thule	914 Roadway	http://www.youtube.com/watch?v=V_gwJeiQYVE
92		Thule Parkway 4 Bike Rack - etrailer.com	etrailertv	rack video review and demo	Thule	Parkway	http://www.youtube.com/watch?v=dspY3-Uz9vU
93		Thule 501 Insta-Gater Bike Rack Review Video & Demo	orsracksdirect	rack video review and demo	Thule	501 Insta-Gater	http://www.youtube.com/watch?v=08SSRb3UdV4
94		Planning a Bike Tour : Bike Tours: Racks & Bags	expertvillage	not relevant			http://www.youtube.com/watch?v=s8hh9_T1OZ8
95		Yakima HookUp Hitch Rack Demonstrated by Rack Outfitter	rackoutfitters	rack video review and demo	Yakima	HookUp	http://www.youtube.com/watch?v=XLpm-79J0yQ
96		SportRack Three Bike Folding Bike Rack - etrailer.com	etrailertv	rack video review and demo	SportRack	3 Bike Folding	http://www.youtube.com/watch?v=2o_l2yf0f2M
97		Swagman Upright Roof Mounted Bike Carrier Review - etrailer.com	etrailertv	rack video review and demo	Swagman	Upright Roof	http://www.youtube.com/watch?v=XCN4kT5-kmM
98		Thule Parkway 4 Bike Carrier Review - etrailer.com	etrailertv	rack video review and demo	Thule	Parkway	http://www.youtube.com/watch?v=1kRbXvIQeik
99		Swagman XT 4 Bike Rack Review - etrailer.com	etrailertv	rack video review and demo	Swagman	XT4	http://www.youtube.com/watch?v=PObx2sIjPIY
100		Swagman XP 3 Bike Rack for 1-1/4 Hitch Review - etrailer.com	etrailertv	rack video review and demo	Swagman	XP3	http://www.youtube.com/watch?v=st6njvqUvwo
101		Rola TX-102 2 Bike Rack Review - etrailer.com	etrailertv	rack video review and demo	Rola	TX-102	http://www.youtube.com/watch?v=aWmvsqBq-J4
102		WDBJ-7 Coverage of the Bike Rack Donation Program	RIDESolutions	not relevant			http://www.youtube.com/watch?v=hA7aDj-QLSw
103		Bicycle Maintenance Tips : How to Buy a Bike Rack for Your Car	expertvillage	how to buy a rack			http://www.youtube.com/watch?v=Xuf9VuaCOQI
104		Yakima SwingDaddy Demonstrated by Rack Attack	rackattackDOTcom	rack video review and demo	Yakima	SwingDaddy	http://www.youtube.com/watch?v=OWLsU6LVc50
105		Storage Dock Bike Rack Cargo Carrier Assembly - etrailer.com	etrailertv	garage racking system			http://www.youtube.com/watch?v=Ae_DlgGyo44
106		Storage Dock, Bike Rack and Cargo Carrier - etrailer.com	etrailertv	garage racking system			http://www.youtube.com/watch?v=nle86uITCoM
107		Thule T2 2 Bike Wheel Mount Bike Rack Review - etrailer.com	etrailertv	rack video review and demo	Thule	T2	http://www.youtube.com/watch?v=MxfG0exe_20
108		Vintage English 3-Speed Bicycles : English 3-Speed Bicycle Racks	expertvillage	not relevant			http://www.youtube.com/watch?v=gaOv8QX75IM
109		Thule Parkway 2 Bike Carrier Review - etrailer.com	etrailertv	rack video review and demo	Thule	Parkway	http://www.youtube.com/watch?v=nVnGsdLCU0
110		http://www.youtube.com/watch?v=JUSckmHeGTg	kylemetcalf	not relevant			http://www.youtube.com/watch?v=JUSckmHeGTg

111		Swagman XP 3 Bike Rack for 1-1/4 Hitch Review - etrailer.com	etrailerv	rack video review and demo	Swagman	XP3	http://www.youtube.com/watch?v=CpQkyihboCM
112		Yakima KingPin 5/4/2 Hitch Bike Racks Review Video & Demo	orsracksdirect	rack video review and demo	Yakima	King Pin	http://www.youtube.com/watch?v=gSyBnQ4J1B4
113		SportRack Anti-Rattle Hitch Bike Rack Lock - etrailer.com	etrailerv	lock video review and demo			http://www.youtube.com/watch?v=PPSPevr1tSg
114		Thule 518 Echelon	rackattackDOTcom	rack video review and demo	Thule	518 Echelon	http://www.youtube.com/watch?v=peTgVrY1R-k
115		Thule 598 Criterium Demonstrated by Rack Attack	rackattackDOTcom	rack video review and demo	Thule	598 Criterium	http://www.youtube.com/watch?v=i87FZDZRpww
116		Saris Thelma Bike Carrier Demonstrated by Rack Outfitters	rackoutfitters	rack video review and demo	Saris	Thelma	http://www.youtube.com/watch?v=iOdDiVfs4wg
117		Topline Expandable Truck Bed Bike Rack Demo - etrailer.com	etrailerv	rack video review and demo	Topline	Truck Bed	http://www.youtube.com/watch?v=GZDK9AWz5XY
118		Yakima King Cobra Demonstrated by Rack Attack	rackattackDOTcom	rack video review and demo	Yakima	King Cobra	http://www.youtube.com/watch?v=nnSnY_RsiMw
119		Thule Spare Me Spare Tire Mount Bike Rack - etrailer.com	etrailerv	rack video review and demo	Thule	963 Spare Me	http://www.youtube.com/watch?v=RbnPiZPIBJE
120		Swagman 4 Bike Carrier Review - etrailer.com	etrailerv	rack video review and demo	Swagman	4 Bike Carrier	http://www.youtube.com/watch?v=OeJ8w0NIA9U
121		BIKE NIGHT TIGHT RACK	Ricos32	not relevant			http://www.youtube.com/watch?v=hZneURhrBds
122		Saris Guardian Bike Rack Installation	SarisRacks	rack video review and demo	Saris	Guardian	http://www.youtube.com/watch?v=SHGbggdAAXA
123		Saris Thelma Bike Rack Installation	SarisRacks	rack video review and demo	Saris	Thelma	http://www.youtube.com/watch?v=GC008uHKIZI
124		Trailer Hitch Mounted Bike Rack Comparison - etrailer.com	etrailerv	how to buy a rack			http://www.youtube.com/watch?v=bcvzSo_vvv4
125		Thule 961XT / 962XT Speedway Trunk Strap-On Bike Rack Video	orsracksdirect	rack video review and demo	Thule	961 Speedway	http://www.youtube.com/watch?v=z7J1QyR-P9Q
126		Saris Bones 3-Bike Rack Installation	SarisRacks	rack video review and demo	Saris	Bones	http://www.youtube.com/watch?v=IE7KamKITGg
127		08-07-08 moped locked to post and ring bike rack	cambridgecyclist	not relevant			http://www.youtube.com/watch?v=YzI3aRknn4E
128		Saris Bones RS Bike Rack Installation	SarisRacks	rack video review and demo	Saris	Bones	http://www.youtube.com/watch?v=d3zjRPb-tro
129		How to Pick Bicycle Parts & Accessories : Bicycle Racks & Bags Tips	expertvillage	not relevant			http://www.youtube.com/watch?v=G2XKgrNcdCU
130	N	bike carrier	sacul77	user innovation			http://www.youtube.com/watch?v=phHp200xn5U
131		How to Use a Bike Rack	Midwest6	public bus rack demo			http://www.youtube.com/watch?v=FOVc_1_ixVU
132		Thule 594 SideArm Bike Rack Review Video & Demo	orsracksdirect	rack video review and demo	Thule	594 SideArm	http://www.youtube.com/watch?v=v4wNQzqrhbs
133		2006 Gillig bus bike rack use	Transitriders	public bus rack demo			http://www.youtube.com/watch?v=Mro5_isAcE8
134		Primo Bike Rack Mini	MikeSchneider	not relevant			http://www.youtube.com/watch?v=RTn0RRFmuOc
135	O	Yakima QuickBack Trunk Mount Bike Rack	rackoutfitters	rack video review and demo	Yakima	QuickBack	http://www.youtube.com/watch?v=oUy-teznmM
136		Bike Rack.mov	NuVisionProductions	public bus rack demo			http://www.youtube.com/watch?v=ydMeW3NgWQw
137		Thule 914 Roadway 4 Bike Rack Features - etrailer.com	etrailerv	rack video review and demo	Thule	914 Roadway	http://www.youtube.com/watch?v=cTmCbCmF4
138		Rack Outfitters Reviews the Yakima SprocketRocket	rackoutfitters	rack video review and demo	Yakima	SprocketRocket	http://www.youtube.com/watch?v=pO4XwbsQuLM
139		Rack Outfitters Reviews the SportRack 2EZ	rackoutfitters	rack video review and demo	SportRack	2EZ	http://www.youtube.com/watch?v=tf6xlCSlJdw
140		Installing Bicycle Parking	lowabicyclecoalition	outdoor racking			http://www.youtube.com/watch?v=Evek8_kgCDs
141	P	Custom Bike Rack - V	deemstyle	user innovation			http://www.youtube.com/watch?v=g8e2yxYroBE
142		Bike Rack Abs. No Gym, No Problem!	MilitaryCoreBodyFit	not relevant			http://www.youtube.com/watch?v=T-mWsvr4DqE
143		Thule 963 Spare Me 2 Bike Spare Tire Rack - etrailer.com	etrailerv	rack video review and demo	Thule	963 Spare Me	http://www.youtube.com/watch?v=VyADrsVM-c8
144		Rocky Mounts Lariat SL (SLX)-Noose SL (SLX) Bike Racks Video	orsracksdirect	rack video review and demo	Rocky Mounts	Lariat	http://www.youtube.com/watch?v=pL-B3nxYp9U
145		Bicycle Timelapse	MagnanimusMichael	not relevant			http://www.youtube.com/watch?v=kpT2TW1Vmw
146		Bicycle Mount	cba110	user study			http://www.youtube.com/watch?v=Lc8AU3yvd2Q
147		How To Use Transit Bicycle Racks	rtcsnvdotcom	public bus rack demo			http://www.youtube.com/watch?v=PkmqZ-CjFg
148		Welding a Bike Rack	SloRide	outdoor racking			http://www.youtube.com/watch?v=daDO_H0TxDb

149		Vintage Muscle Bicycles : Vintage Muscle Bicycle Racks	expertvillage	not relevant			http://www.youtube.com/watch?v=M7IX_YcMcBU
150		U-Locks 101	svref	not relevant			http://www.youtube.com/watch?v=1KwIWOQ3QvY
151		Thule 982 Adapter for Trunk & Hitch Bike Racks Video Demo	orsracksdirect	rack video review and demo	Thule	982 Adapter	http://www.youtube.com/watch?v=e_C5XHb6j94
152		BIKE NIGHT TIGHT RACK	Ricos32	not relevant			http://www.youtube.com/watch?v=hZneURhBds
153		Brian And Biebel Bike rack Sesh	lordgilbertii	not relevant			http://www.youtube.com/watch?v=3KrrvnKp00Y
154		Loading bikes onto a bike rack	maxrxaxx	rack video review and demo	MaxxRaxx	not provided	http://www.youtube.com/watch?v=LAWiIM1vqj8
155		SportRack 4 Bike Wheel Mount Rack Review - etrailer.com	etrailertv	rack video review and demo	SportRack	4 Bike Wheel Mount	http://www.youtube.com/watch?v=1WGa0PrPaU
156		Primo Bike Rack Rail	Burroughs Gralen	not relevant			http://www.youtube.com/watch?v=PpgHbFVFRs4
157		Rola 4 Bike Rack TX-104 Demo - etrailer.com	etrailertv	rack video review and demo	Rola	TX-104	http://www.youtube.com/watch?v=UTe_rIH920k
158		SportRack Escape Tilting 3 Bike Rack Review - etrailer.com	etrailertv	rack video review and demo	SportRack	Escape Tilting	http://www.youtube.com/watch?v=XPaaAldxvFU
159		tyler grinding a bike rack	pcrossley93	not relevant			http://www.youtube.com/watch?v=ovsgnn4X040
160		MAUI PUBLIC TRANSIT (BIKE-FRIENDLY) BUS BIKE RACKS	MISSISSAUGAWATC H	public bus rack demo			http://www.youtube.com/watch?v=pQdZw-n_WAo
161		SportRack Folding 3 Bike Rack Review - etrailer.com	etrailertv	rack video review and demo	SportRack	Folding 3	http://www.youtube.com/watch?v=MRRXjTsJWZM
162		Rack Outfitters Demonstrates the Yakima FullSwing 4 Bike	rackoutfitters	rack video review and demo	Yakima	FullSwing	http://www.youtube.com/watch?v=fb414YU65c
163	Q	Mottez 4 towball mounted bike rack	wilstowtrailers	rack video review and demo	Mottez	4 Towball	http://www.youtube.com/watch?v=e5xUN-H5KIs
164	R	Take A Seat - Bike Rack	Sonicandpalsdotcom	user innovation			http://www.youtube.com/watch?v=4tFijwWINU
165		Saris Bones RS Demonstrated by Rack Outfitters	rackoutfitters	rack video review and demo	Saris	Bones	http://www.youtube.com/watch?v=cYm23C3X5Jc
166		WeeRide Bicycle Seat Advert	myweeridecom	not relevant			http://www.youtube.com/watch?v=FkO8OTrYvfi
167		SportRack Three Bike Folding Rack Assembly - etrailer.com	etrailertv	rack video review and demo	SportRack	3 Bike Folding	http://www.youtube.com/watch?v=x_VGVTDafMA
168		Saris T-Rax Bike Rack Installation	SarisRacks	rack video review and demo	Saris	T-Rax	http://www.youtube.com/watch?v=7Z915BV5ggY
169		Thelma Juvenile Bike Rack Installation	SarisRacks	rack video review and demo	Saris	Thelma	http://www.youtube.com/watch?v=IkW3v13k49M
170		Bike Rack Session	Grommit	not relevant			http://www.youtube.com/watch?v=P0Xbb8cLdiw
171		the bike rack	Am8y	not relevant			http://www.youtube.com/watch?v=KdMy_rnmKQY
172		mk1 rs 2000 filmed early 90's with bike rack	tonyfordcosworth	user study			http://www.youtube.com/watch?v=UMORUC-25gk
173		Loading your Bike on a Bus	iowabicyclecoalition	public bus rack demo			http://www.youtube.com/watch?v=HBDZniSIL70
174		Kuat Bike Rack Demonstrated by Rack Outfitters	rackoutfitters	rack video review and demo	Kuat	Alpha	http://www.youtube.com/watch?v=NUG-lv5OAio
175		Rola Tilting Four Bike Rack TX 104 - etrailer.com	etrailertv	rack video review and demo	Rola	TX-104	http://www.youtube.com/watch?v=yopbavdfHlg
176		Bike Rack - Buying the right one...	4wheelsonline	how to buy a rack			http://www.youtube.com/watch?v=dVvYEaqueSE
177		SportRack Bike Rack Locking Kit - etrailer.com	etrailertv	lock video review and demo			http://www.youtube.com/watch?v=c27Un4AEQdc
178	S	Triathlon Bike Rack Assembly/Disassembly	speedroo	triathlon rack			http://www.youtube.com/watch?v=hA3UqClfb8
179		Triathlon Bike Rack Kit - Assembly/Disassembly	speedroo	triathlon rack			http://www.youtube.com/watch?v=H_DfIUv_rvs
180		Valley 3 Bike Towing Bike Rack, Clamp Style - etrailer.com	etrailertv	rack video review and demo	Valley	3 Bike Towing	http://www.youtube.com/watch?v=2Kr9BizmT-4
181		http://www.youtube.com/watch?v=mqfPdRT5U1Q	dylanbakner1212	not relevant			http://www.youtube.com/watch?v=mqfPdRT5U1Q
182	T	Smart Car Bike Rack	ciscocali	rack video review and demo	SmartCar Performance	not provided	http://www.youtube.com/watch?v=XuyHHmfoYI
183		Family bike rack	tourde66	user study			http://www.youtube.com/watch?v=IDVNemiozNY
184		Attaching a MAXXRAXX tow bar mounted bike rack	maxrxaxx	rack video review and demo	MaxxRaxx	not provided	http://www.youtube.com/watch?v=oJWlG5VeAv8
185	U	Mont Blanc cycle carrier www.montblancuk.co.uk	siobhankos	other relevant			http://www.youtube.com/watch?v=_zceTzi8nk
186		SportRack Escape Bike Rack Demonstrated by Rack Outfitters	rackoutfitters	rack video review and demo	SportRack	Escape 4	http://www.youtube.com/watch?v=N1zwbUqv3n0

187		Yakima ForkLift Demonstrated by RackOutfitters.com	rackoutfitters	rack video review and demo	Yakima	ForkLift	http://www.youtube.com/watch?v=cGmBIfC3_yA
188		Thule Roadway 2 Bike Rack Review - etrailer.com	etrailertv	rack video review and demo	Thule	914 Roadway	http://www.youtube.com/watch?v=kW1xgk12A
189		Swagman 4 Bike Carrier Review - etrailer.com	etrailertv	rack video review and demo	Swagman	4 Bike Carrier	http://www.youtube.com/watch?v=TbWl6ZLvcYo
190		Front Carrier Block Installation	Hoop6102	not relevant			http://www.youtube.com/watch?v=DzxBjWjMlc
191	V	Bus Bike Rack, The #1 Bike Rack For Buses & Transit Authorities	mwbixuser17	public bus rack demo			http://www.youtube.com/watch?v=8eB3-YUI8ik
192		Rack Outfitters Demonstrates the Yakima HighRoller	rackoutfitters	rack video review and demo	Yakima	HighRoller	http://www.youtube.com/watch?v=w5dPxBgM5Jg
193		Thule Bike Rack Frame Adapter - etrailer.com	etrailertv	other relevant			http://www.youtube.com/watch?v=hbjFeNRllik
194		Wild Ride bakfiets	frankje169	not relevant			http://www.youtube.com/watch?v=EsTR-0NZHbs
195		HSR Bike Rack Loading	mentatoom	public bus rack demo			http://www.youtube.com/watch?v=2A1sBORwL2Q
196		Bike Rack.	MrRemedyz	not relevant			http://www.youtube.com/watch?v=5MNUjU0RqBo
197		Rack Outfitters Demonstrates the Yakima KingPin Series	rackoutfitters	rack video review and demo	Yakima	KingPin	http://www.youtube.com/watch?v=Wpn6yggkdz0
198		Stuff on bike rack	SchrijnSkater99	not relevant			http://www.youtube.com/watch?v=vbV605Lnr4
199	W	Softride Access Dura Bike Rack	pacrecproducts	rack video review and demo	Softride	Dura	http://www.youtube.com/watch?v=sJz90F15G4
200	X	Bike-Rack	MiniLinkSystem	rack video review and demo	MiniLink	not provided	http://www.youtube.com/watch?v=CvHgMKBQe8
201		Thule 914 Roadway 4 Bike Rack Assembly - etrailer.com	etrailertv	rack video review and demo	Thule	914 Roadway	http://www.youtube.com/watch?v=HjK1hJizXew
202		Rocky Mounts Noose Demonstrated by Rack Outfitters	rackoutfitters	rack video review and demo	Rocky Mounts	Noose	http://www.youtube.com/watch?v=gl-k027KH_U
203		Custom Bike Rack - I	deemstyle	user innovation			http://www.youtube.com/watch?v=p03Y_BEf7Qg
204		Bicycle Repair & Ownership : Bicycle Car Racks	expertvillage	how to buy a rack			http://www.youtube.com/watch?v=8rZsu6ELJtE
205		270 onto bike rack BALL	RYNsno	not relevant			http://www.youtube.com/watch?v=UkhPDGN-05o
206		Softride Access Versa Bike Rack	pacrecproducts	rack video review and demo	Softride	Versa	http://www.youtube.com/watch?v=G6yelK9mhq8
207		City Racks Bike Rack Design	adarch	outdoor racking			http://www.youtube.com/watch?v=t5ylim8VIE
208		motorized bike rack mount	bgoates	not relevant			http://www.youtube.com/watch?v=sEpwHpxAqg
209		bike fun rack	vao26	outdoor racking			http://www.youtube.com/watch?v=wrt7TU2w-Rg
210		high ollie over bike rack	DOitNOWsk8	not relevant			http://www.youtube.com/watch?v=sEQXJ2oHaM
211		Rola Four Bike Rack TX-104 Assembly - etrailer.com	etrailertv	rack video review and demo	Rola	TX-104	http://www.youtube.com/watch?v=Tlh2KR7PuVs
212		huge ollie over a bike rack	hungin	not relevant			http://www.youtube.com/watch?v=_AV8SmF29xo
213		Bike rack fall	xdickjohnsonx	not relevant			http://www.youtube.com/watch?v=9r95v13vEx0
214		3-D Bike Rack	FreeRiderChaz	not relevant			http://www.youtube.com/watch?v=kryy2uc2Cl4
215		The Moto Jack Dirt Bike carrier is back and better than ever	azman67	motorcycle carrier			http://www.youtube.com/watch?v=ZpJ-8Uq77yA
216		Saris Bones Series Demonstrated by Rack Outfitters	rackoutfitters	rack video review and demo	Saris	Bones	http://www.youtube.com/watch?v=aNTcDDNK6PE
217		Flex-it-Fix-it	matriskie	not relevant			http://www.youtube.com/watch?v=OuN7OJE7eZA
218		Bike Rack For Buses -- Affordable and Easy To Use Bus Bike Rack	mwbixuser17	public bus rack demo			http://www.youtube.com/watch?v=HB1sjjodT-M
219		How to Install a Bike Rack	jennbress	not relevant			http://www.youtube.com/watch?v=xgREb-sLJR8
220		Triathlon Bike Rack Assembly/Disassembly Closer View	speedroo	triathlon rack			http://www.youtube.com/watch?v=lxQT84IFog
221		Valley 3 Bike Towing Bike Rack, Clamp Style - etrailer.com	etrailertv	rack video review and demo	Valley	3 Bike Towing	http://www.youtube.com/watch?v=2Kr9BlzmT-4
222		rack	dylanbakner1212	not relevant			http://www.youtube.com/watch?v=mqfPdRT5U1Q
223		Thule Revolver Bike Rack	racksforall	rack video review and demo	Thule	964 Revolver	http://www.youtube.com/watch?v=s4mJfx8Pcrk
224		Rola 2 Bike Rack - etrailer.com	etrailertv	rack video review and demo	Rola	2 Bike	http://www.youtube.com/watch?v=X8O2GobggFk

225		Multiple Bike Rack Challenges	rubofthegrenz	not relevant			http://www.youtube.com/watch?v=lyNkg85M-3Y
226	Y	1st video showing installation of bike rack and golf bag	leverlatchlock	user innovation			http://www.youtube.com/watch?v=aSuzJW4EgpA
227		Vintage Balloon Tire Bicycles : Vintage Balloon Tire Bicycle Racks	expertvillage	not relevant			http://www.youtube.com/watch?v=Eb9HnWiQ4UA
228		£39.99 Buy from sjscycles.co.uk - Bike Caddy 3 bike carrier	SJSCycles	rack video review and demo	SJS	Bike Caddy	http://www.youtube.com/watch?v=VCA-kAgGJKI
229		Vintage Middleweight Bicycles : Vintage Middleweight Bicycle Racks	expertvillage	not relevant			http://www.youtube.com/watch?v=adv8d8xJsGo
230		Kuat Alpha and Beta Demonstrated by Rack Outfitters	rackoutfitters	rack video review and demo	Kuat	Alpha	http://www.youtube.com/watch?v=7V3ovQC3RCe
231		BusBikeRack.com The Bike Rack For Buses -- Easy and Affordable	mwbixuser17	public bus rack demo			http://www.youtube.com/watch?v=i5EpMerjG_I
232		Custom Bike Rack - IV	deemstyle	user innovation			http://www.youtube.com/watch?v=PacurUw6lw8
233		Bike Rack	essjay94	not relevant			http://www.youtube.com/watch?v=NlvkLqYzHel
234		The Bike Rack	fashionable artist	not relevant			http://www.youtube.com/watch?v=J8wW2ayLq_s
235		Velo Glide Bicycle Storage System	harpua1234	garage racking system			http://www.youtube.com/watch?v=1bNfJiPtSPk
236		Bike Rack Dance	carfreedays	not relevant			http://www.youtube.com/watch?v=arrBJOxWrZg
237		The Closet Bike Rack in Action	TaraFitz21	garage racking system			http://www.youtube.com/watch?v=h1Zxn0yfg3Y
238		Ottawa: Where are the gay bike racks?	xtraonline	outdoor racking			http://www.youtube.com/watch?v=be0rGqQrrkE
239		Hollywood Racks E3 Express 3-Bike Trunk Mount Rack	155cafe	rack video review and demo	Hollywood	E3 Express	http://www.youtube.com/watch?v=dAJ3XknOyxk
240		Using The Bike Racks	Razorback Transit	public bus rack demo			http://www.youtube.com/watch?v=5qWbvQlbpKM
241		grinding bike rack	xplosionbaseball	not relevant			http://www.youtube.com/watch?v=6VEqpbK3AXo
242		08 CMI EF Sedan Stock LSVTEC w/ BIKE RACK!!	YoungStatic	not relevant			http://www.youtube.com/watch?v=rkz7MjyYbig
243		MegaVideos - Redneck bike rack	MegaVideosRnJ	not relevant			http://www.youtube.com/watch?v=QreTVesZA4A
244		ADD-A-BIKE DIRT BIKE CARRIER	GORILLATOPS	motorcycle carrier			http://www.youtube.com/watch?v=2LLDP1-1Nrs
245		Nissan Frontier / Titan Velocigrip Bike Rack	magrinds	rack video review and demo	Titan	Velocigrip	http://www.youtube.com/watch?v=6ZbJTjwQxUE
246		SJS eBay car bike rack	SJSCycles	rack video review and demo	SGS	not provided	http://www.youtube.com/watch?v=JyivucvM8q
247		rico riding a bike rack	snipeourdead	not relevant			http://www.youtube.com/watch?v=ITcu6VAdxtE
248		Yakima King Joe Series Demonstrated by Rack Outfitters	rackoutfitters	rack video review and demo	Yakima	King Joe	http://www.youtube.com/watch?v=cLHlP_FnF4
249		me and rico riding the bike rack.3g2	snipeourdead	not relevant			http://www.youtube.com/watch?v=A67idHsaung
250		ollie over a bike rack	WhatsAposton	not relevant			http://www.youtube.com/watch?v=RIYkvQNskGE

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