The Application of TRIZ to Technology Forecasting
A Case Study: Brassiere Strap Technology

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Abstract

Companies must continually develop new products or improve upon existing ideas in order to keep up with competitive markets. One tool to stimulate creative product development is TRIZ (Theory of Inventive Problem Solving). This paper describes a case study applying TRIZ to forecast the technology development of the bra strap. The TRIZ methodology is used to determine the existing state of the technology and its future potential. It is shown how TRIZ can be used to stimulate new product ideas.

Technology Forecasting – Why TRIZ?

In today's competitive market, manufacturing companies are looking for an edge on their competitors. One area in which this edge can be gained is the development of innovative new products. There is a multitude of traditional, established forecasting tools, such as intuitive or judgmental models, curve fitting and extrapolation of trends, or statistical time series models, used to aid a company's research and development department in making strategic decisions for product development [1, 2]. Generally, these forecasting methods are based on the choice and analysis of individual, specific parameters as descriptors of the technology. As a result, the concluded forecasts may be subjective and may not reflect all aspects of the technology.

A different, complementary approach to technology forecasting is provided by tools of the Theory of Inventive Problem Solving, known by the Russian acronym TRIZ. The TRIZ approach is structured and systematic, assuring a close-to-objective analysis of the entire technological system from the past to the future. In addition, the TRIZ forecasting methodology seamlessly expands to produce innovative ideas for new product development based on the status of the product technology in the market [3].

TRIZ Background

In the 1940's, Russian Inventor Genrich Altshuller developed a theory to describe how inventions are generated, based on the extensive analysis of thousands of patents. His research led to the creation of the theoretical superstructure TRIZ. TRIZ is a system of many powerful tools for problems analysis, understanding and solution, which can be applied to accelerate product development resulting in a patented solution [4].

Several TRIZ tools focus on problem solving during product development, such as the *40 Principles* to solve contradictions, the concept of *Ideality*, or the *Substance-Field Analysis*. In addition, TRIZ offers tools to determine the status and the future of a specific product technology. Some of the tools used are:

- Analysis of the technological system in the past, present and future
- Analysis of the technological system at different detail levels
- Determination of trends of evolution
- Maturity mapping [3, 4]

The purpose of this paper is to show how TRIZ can forecast and innovate the product development process using the bra strap as a case study. The systematic approach in this study shows that the TRIZ method of technology forecasting can seamlessly lead into new, innovative product ideas. These ideas can accelerate a company's product development process as a whole.

History of the Bra

The term brassiere was first utilized by Vogue Magazine in 1907, but first records of bra-like garments date back to 2500 BC. The first known patents for these devices were filed in the 1850's. In 1893, Marie Tucek designed the first brassiere that resembled the modern day brassiere [5]. The design consisted of a separate pocket for each breast, hook-and-eye closures, and shoulder straps. Since then, the components of the bra have evolved according to required functions and changing fashion. Some of the many functions include minimizing, enhancing, supporting, and increasing comfort.

TRIZ Patterns of Evolution of Technological Systems

In his analysis of patents in many different technologies, Altshuller recognized eight patterns in how systems develop over time [4, 6, 7]:

1. Evolution in Stages (Technical system follows the biological s-curve)
2. Evolution Towards Increased Ideality
3. Non-uniform Development of System Elements (Subsystems evolve at different rates)
4. Evolution Toward Increased Dynamism and Controllability
5. Increased Complexity then Simplification (Reduction)
6. Evolution with Matching and Mismatching Components
7. Evolution Toward Micro-level and Increased Use of Fields
8. Evolution Toward Decreased Human Involvement

These eight patterns can be exploited individually to analyze where a technology is coming from, and to generate ideas about where the technology will evolve in the future. In the following sections of this paper, several tools relating to the individual patterns of evolution will be used to determine the state of bra strap technology, and develop new product ideas.

Evolution in Stages - TRIZ Maturity Mapping

Biological and technological systems go through different steps of evolution. Altshuller used his research to categorize evolution into four stages: infancy, growth, maturity, and decline. The utilization of this theory allows companies to not only see the current state of the technology, but also to be able to predict its future fate and potential. Figure 1 shows the "Biological S-Curve" developed by Altshuller [4].

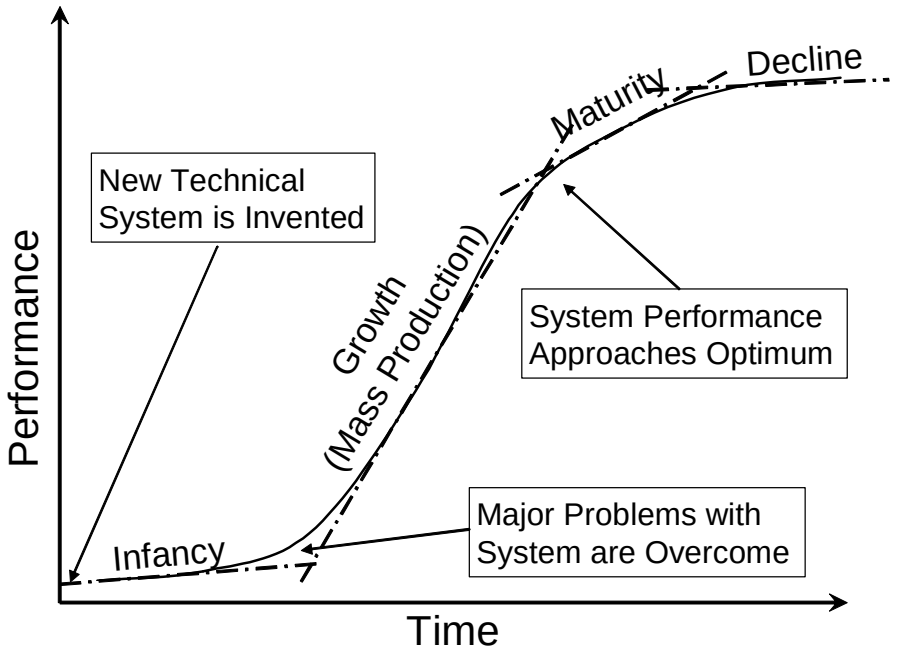

Figure 1: Biological S-Curve [4, 8]

In order to determine at which stage of the Biological S-Curve a current technology is located, Altshuller developed four descriptive curves, as shown in Figure 2: A) Number of inventions or patents over time, B) Level of inventiveness over time, C) Performance over time, and D) Profitability over time.

The dotted vertical lines in the graphs of Figure 2 divide each of the curves into the four stages of the Biological S-Curve.

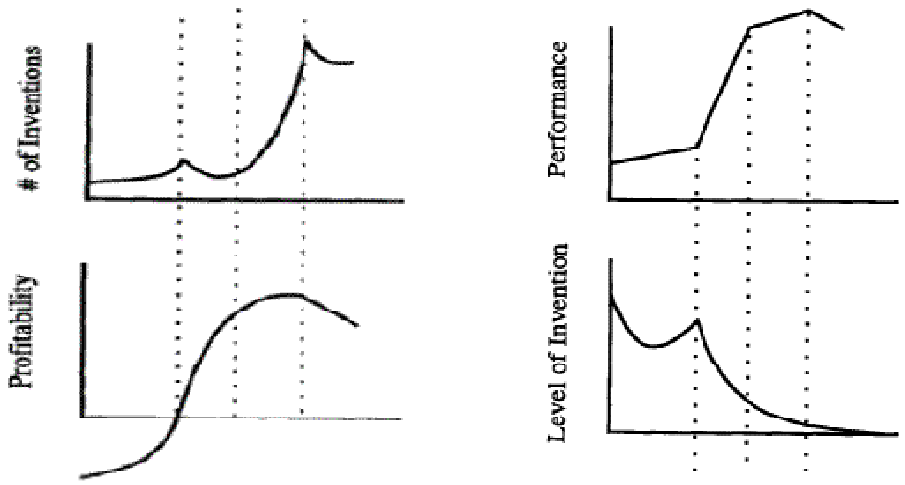

Figure 2: Descriptive Curves Over Time [6]

Maturity Mapping of the Bra Strap

A patent search covering the time period from 1976 to the present was conducted, relating to the bra strap. Combinations of several descriptors, such as *bra*, *strap*, *strapless*, *brassiere*, *lingerie*, *underwear*, were used, in order to assure a complete and concise patent data base. The search (*bra* and *strap*) produced 336 patents. The search was narrowed using (*bra* and *strap* andnot *strapless*). The titles and abstracts of the 291 results for this search were evaluated. Of these 291 patents, about 150 patents were identified that truly contained a novelty relating to the strap of the bra. Upon closer examination, some of these patents were traced back to their reference patents, which also contained inventions concerning the bra strap. The resulting patent collection of 172 patents is attached as Appendix A. Some patents include inventions relating to sections of the bra other than the bra strap. However, the comprehensive patent search as described above assured that every patent containing an invention relating to the strap of the bra was included in the patent database.

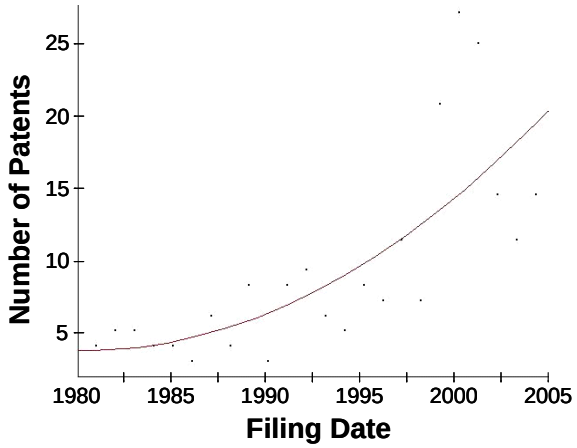

Figure 3: Number of Patents Over Time

In Figure 3, the number of patents is plotted over a time axis. While the individual points depict the data found for each individual year, the continuous graph shows the best fit of an averaged curve.

In order to generate the descriptive graph for "Level of Inventiveness", the patents were assessed quantitatively based on Altshuller's "5 Levels of Inventiveness". Each patent was analyzed in terms of five different criteria:

A) Field of invention vs. field of problem
B) Solution mechanism
C) Characteristics of the system
D) Effects or principles leading to the invention
E) Existence of contradictions

Each criterion is categorized at a level between one and five, five being the most inventive. The final rating of inventiveness or innovation rating as plotted in Figure 4 is calculated as the average of the rating in each category. A concise table depicting the rating criteria is attached as Appendix 2.

The individual points in Figure 4 show the average ratings of all patents filed in each single year. The continuous graph depicts the best fit of an averaged curve of the innovation level of all patents as analyzed.

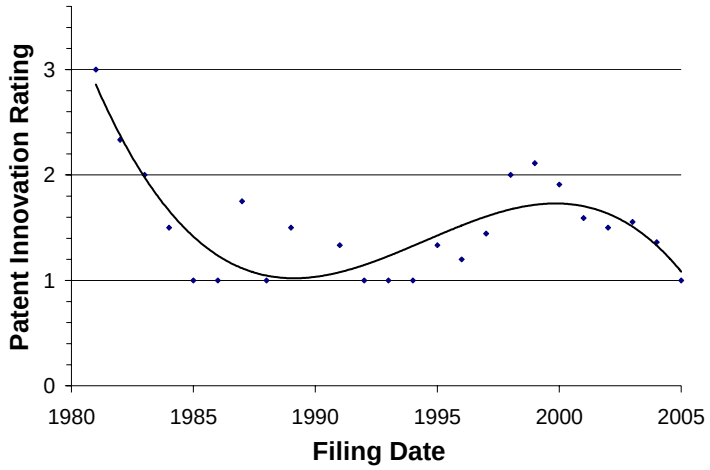

Figure 4: Patent Innovation Level Over Time

Data for the performance or profitability of the bra strap were unavailable, since these parameters are either kept confidential by the manufacturers, or they are accessible only at a high price from commercial market research companies.

The next step towards maturity mapping of the bra strap technology was to compare the graphs for *Number of Patents* and *Patent Inventiveness over Time* with the corresponding descriptive curves developed by Altshuller.

The bra, complete with an early type of strap, was first invented and patented in the 1850s. This corresponds to the beginning of Altshuller's curve at the infancy stage. The rising number of patents in the bra strap technology in recent years can be fit to Altshuller's descriptive, qualitative curve for *Number of Patents over Time* in the maturity phase, as indicated with a red box in Figure 5.

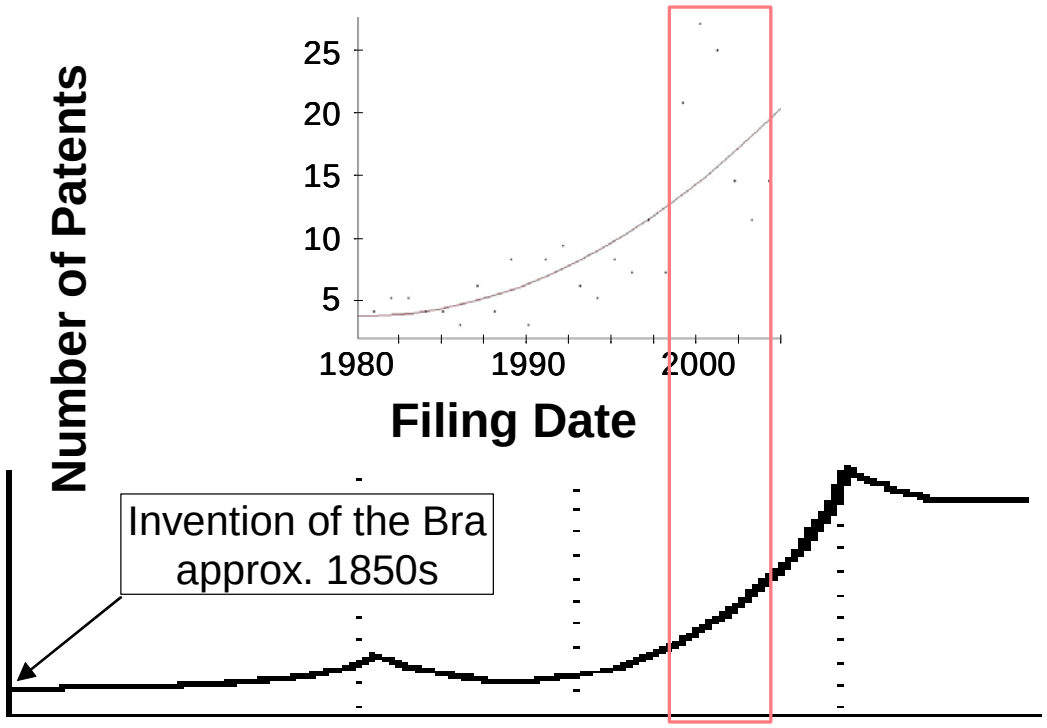

Figure 5: Number of Patents over Time – Fit of Bra Strap Data

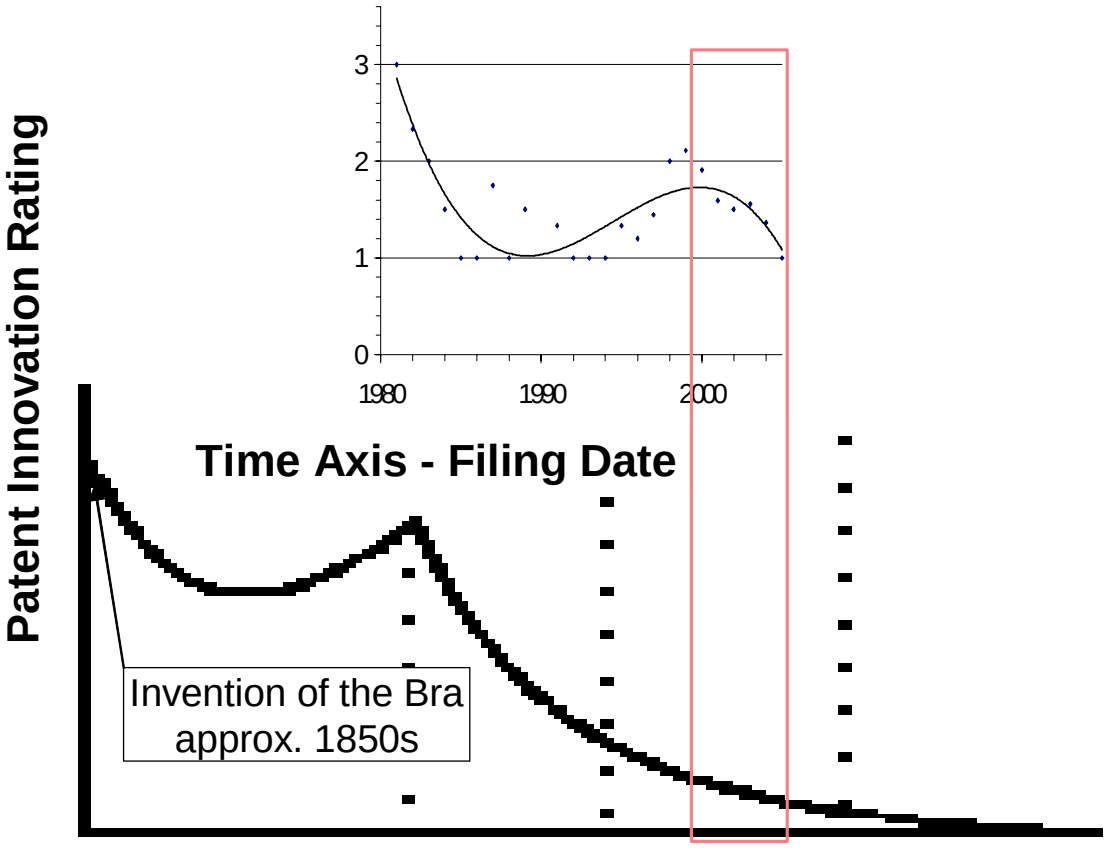

Figure 6: Patent Innovation Rating over Time – Possible Fit of Bra Strap Data

This conclusion is confirmed by the fit of the curve for *Patent Innovation Level*, depicted in Figure 6. A decline in patent inventiveness from the 1980s to the present matches the growth and maturity phase. The slight bump in innovation level of the bra strap during the maturity phase can be interpreted as the addition of innovative features to the strap as an attempt to rejuvenate the technology. According to Figure 6, the bra strap technology has reached the maturity phase in the present, as indicated with a red box. Analysis of both, *Number of Patents* and *Patent Innovation Level*, indicates that the current stage of bra strap technology has reached maturity, as shown in Figure 7.

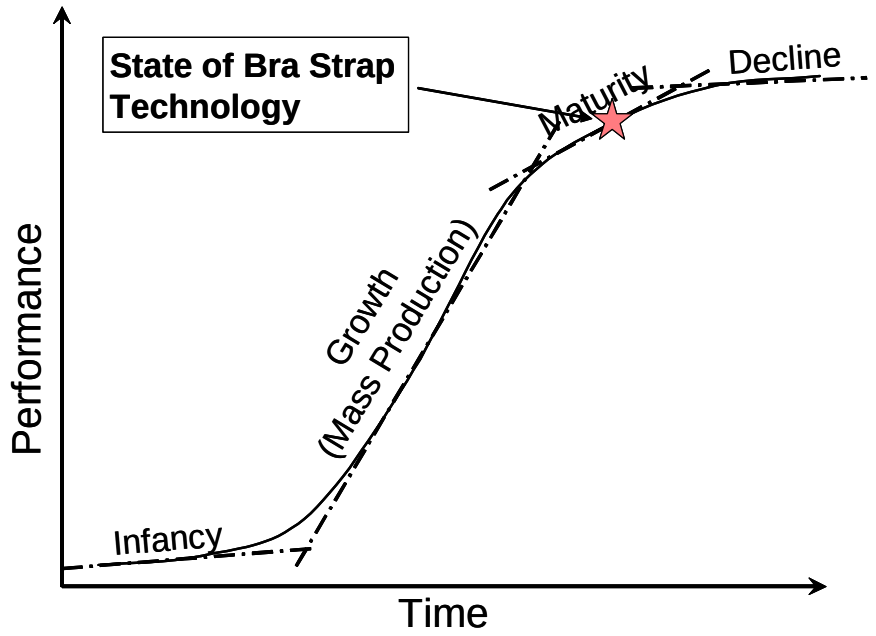

Figure 7: Biological S Curve for Bra Strap Technology

Since the Bra Strap technology is identified to be in the maturity stage of its biological s-curve, its corresponding curves for performance and profitability as shown in Figure 2 are nearing their decline. In order to keep up performance, consumer satisfaction and business profitability, it is essential to rejuvenate the bra strap technology with innovative product development.

The Bra Strap - Ideal Final Result

As stated in the TRIZ *8 Rules of Evolution*, every technological system evolves toward a final "Ideal" system. The formulation of the *Ideal Final Result* helps to focus on the true problem and helps to identify the technical and physical contradiction. There are several different levels and ways to formulate the *Ideal Final Result*. In the case of the bra strap, two possible formulations are:

"The bra supports itself (no strap needed)" or
"The bra strap supports the bra and the breast *and* adds comfort and fashion."

While the first formulation of the Ideal Final Result is a closer approach to an ideal solution for the supersystem bra, the second statement is more helpful for the innovative construction of a bra strap. It states that the bra strap has no harmful effects such as hurting the body or being a fashion flaw; in the opposite, it adds comfort and fashion. This statement for the Ideal Final Result suggests finding actions, substances or fields that can create comfort and fashion in a bra strap in addition to, not in contradiction to, its primary function of giving support.

Analyzing the Ideal Final Result pinpoints contradictions of the system as it currently exists. Why is the current system NOT ideal? In the case of the bra strap, examples for contradictions are:

1. A strap that gives good support digs into the skin and thus causes discomfort.
2. A wide strap that gives good support and does not dig into the skin compromises fashion.
3. An elastic strap that adjusts the tension needed to give just the right amount of support to be comfortable and to not dig into the skin needs a buckle or fastener for the adjustment, which is a fashion flaw.

These contradictions can be formulated by TRIZ in a more abstract way as physical or technical contradictions.

The technical contradiction in situation 1 is that the strap needs to be strong for support, but its strength compromises comfort, as it is putting pressure onto the shoulder. The abstract contradiction is when strength increases (good), pressure increases (harmful effect).

In situation 2 of the example, the contradiction is even simpler. The physical contradiction is that the strap should be wide for comfort and support but narrow for fashion reasons.

In the 3rd situation, the contradiction could be isolated as: the bra strap should be firm for maximum support but should be elastic for maximum comfort.

Development of the Bra Strap - TRIZ Systems Approach

Another pattern of evolution identified in the TRIZ technology is the non-uniform development of subsystems or parts. In order to accelerate innovation, subsystems that hinder product innovation must be identified and addressed. The technology system containing the bra strap was analyzed using the TRIZ Systems Approach. The technology is visualized in a three-by-three matrix with different time levels in the horizontal direction, and different detail levels in the vertical direction. The three time levels analyzed are past, present and future, while the three different detail levels are labeled as *Supersystem*, *System*, and *Subsystem* [9].

The first system approach matrix was created with the idea of the bra as the system, as shown in Figure 8. This matrix helped to realize that the system “bra” contains far too many components and is too complex to serve as basis for new development. Therefore, a complementing matrix at a more detailed level was created using the “bra” as the *Supersystem* and the“bra strap” as the *System*, as shown in Figure 9.

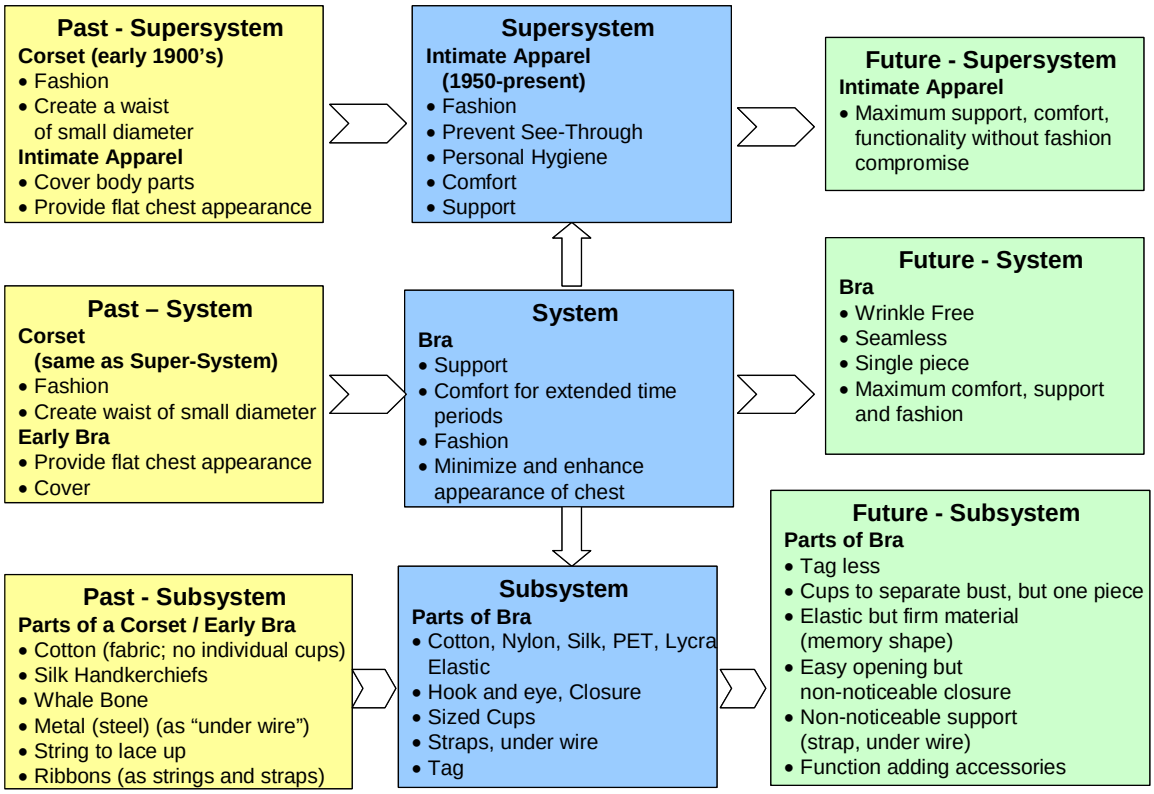

Figure 8: Systems Approach for "Bra" [9]

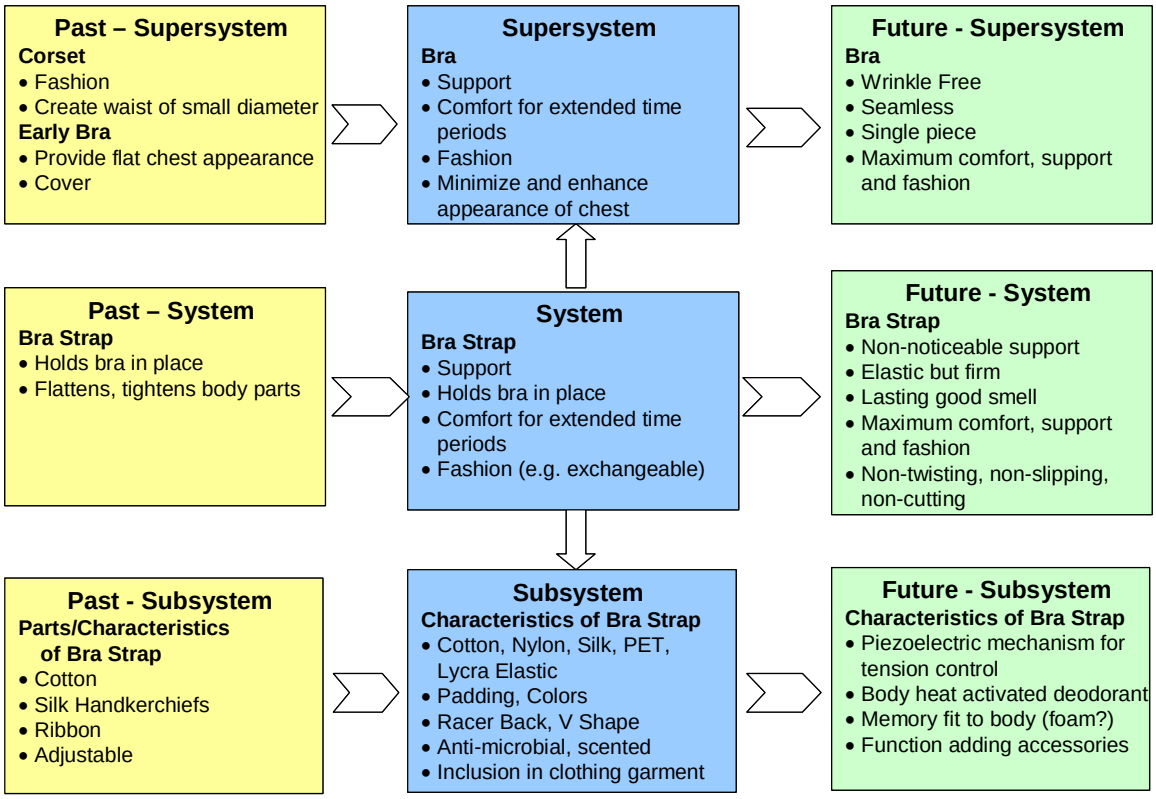

Figure 9: Systems Approach for "Bra Strap" [9]

The Systems Matrix visualizes from two directions to where the bra strap technology might develop in the future. It is of practical help to the development engineer because it forces questions like:

- Which are the subsystems holding back new development and what are their shortcomings?
- What were parts and characteristics of the bra strap in the past, what are the current parts and characteristics and what are possible parts and desirable characteristic relevant for the future?
- What are desirable characteristics of the bra as a whole (and supersystem), how could the bra strap contribute to achieve these and what parts and characteristics at a more detailed level are necessary to achieve these?

A few ideas for a future component of the bra strap displayed in Figure 9 have already been patented, but are not yet commercially developed.

Analysis of the Bra Strap at a Micro-Level

The 7th trend of evolution in TRIZ is the development towards micro-level. Analyzing the system at a microlevel is helpful to address contradictions identified in the system "bra strap". The corresponding TRIZ tool is "Many Little People" modeling, which visualizes the problem in microscopic detail.

In Figure 10, "Many Little People" are performing various functions to counteract the contradictions of the bra strap.

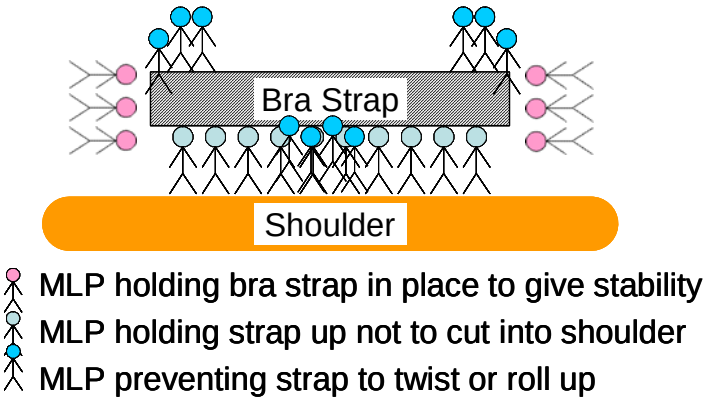

Figure 10: MLP Model of a Bra Strap

The Bra Strap - Analysis of Resources

Hand in hand with the evolution towards micro-level elements, technological systems evolve towards the use of fields. Fields are energy resources available in the system. In addition to energy fields, other kinds of resources that are not recognized at first sight,

may be available in the system. A systematic analysis of all resources of the system can be very helpful to direct creativity in order to develop new, smart, and efficient product ideas. TRIZ publications offer systematic check lists for the type of resources [6, 10]. Resources available for the development of the bra strap are depicted in Table 1.

Table 1: Resources for "Bra Strap"

Type of resource	Specific resource for bra strap
Space (Operation Zone)	Width of shoulder, back, side of body, front of body, arms, lower body
Time	Time before wearing, during wearing, after wearing, during washing, during drying
Internal resources (Objects acted upon, tool)	Body, shoulder, breast, bra strap
External resources (Environment)	Natural magnetic field of earth, gravity
Mechanical resources	Memory, elastic, firm, soft fabric
Thermal resources	Body heat, ambient heat or cool air
Electrical resources	Piezoelectric motor
Chemical resources	Scent releasing devices controlled by heat
Electromagnetic resources	Magnets
Use of harmful functions	Eliminate excess tension, friction

Conclusions - Innovative Ideas for Bra Strap Technology

Based on the analysis of the bra strap functionality using the selected TRIZ tools above, a few ideas for a new bra strap technology were developed. The combination of several different ideas could result in the ideal bra strap.

The bra straps should be exchangeable, anti-microbial, and contain a shape memory material around the top of the shoulder that will adjust to the wearer's exact body contour. The material should be soft and breathable to the touch of the skin, yet stay in its memory shape. The strap should be available in various colors, such as fashion colors and body colors. Since the strap is thin and follows its wearer's body contour, a body colored bra strap would be virtually invisible.

The systematic analysis of bra strap technology in this case study shows that TRIZ can help accelerate product development throughout its entire process. TRIZ tools support the first stages of technology assessment, they are useful for technology forecasting, and they streamline the final development stages of product innovation and patent generation.

References

[1] http://www.marketingprofs.com, MarketingProfs LLC., Los Angeles, CA, 2005

[2] http://www.tfi.com, Technology Futures Inc., Austin, TX, 2005

[3] Terninko, John, Alla Zusman and Boris Zlotin. *Systematic Innovation: An Introduction to TRIZ.* St. Lucie Press: 1998.

[4] G.S. Altshuller: Creativity as an Exact Science. Gordon and Breach Publishers, 1984.

[5] History of the Bra. http://www.blooberry.com/bformfaq/brahist.html. April 28, 2005.

[6] Terninko, John; Zusman, Alla; Zlotin, Boris: STEP-by-STEP TRIZ: Creating Innovative Solution Concepts. 1996 Responsible Management Inc.

[7] Salamatov, Yuri: TRIZ: The Right Solution at the Right Time – A Guide To Innovative Problem Solving. Insytec B.V., 1999.

[8] Mueller, Gernot: Accurately And Rapidly Predicting Next-Generation Product Breakthroughs In The Medical-Devices, Disposable Shaving Systems, And Cosmetic Industries. http://www.triz-journal.com, TRIZ Journal, March 1999.

[9] North Carolina State University, Graduate Course: Theory of Inventive Problem Solving, Spring 1999, Course Notes provided by Ideation International.

[10] Marconi, Janice, Marconi Works, International: ARIZ: The Algorithm for Inventive Problem Solving – An Americanized Learning Framework. TRIZ Journal, April 1998.

Appendix 1 – Patent Database for "Bra Strap"

Patent #	Date Filed	Issue Date	Innovation Rating	Title
3998231	1979	1981	3	Brassiere
3982547	1979	1981	3	Sports brassiere
4174717	1980	1983	2	Two piece brassiere and method of use
4143662	1980	1982	1	Nursing bra
4100924	1980	1982	3	Support brassiere
4076029	1980	1982	3	Fastener for maternity-nursing brassiere
4202343	1981	1983	2	Support brassiere
4144912	1981	1983	2	Front opening bra with adjustable back
4220157	1982	1984	2	Athletic support brassiere
4217905	1982	1984	1	Brassiere
4254777	1983	1985	1	Methods of knitting brassiere blank, manufacturing brassiere, and products
4289137	1984	1986	1	Comfort accessories for brassieres
4276884	1984	1985	1	Brassiere
4341219	1985	1987	2	Brassiere
4335728	1985	1987	3	Laterally stabalized bra strap
4292975	1985	1987	1	Fasteners for apparel and methods of manufacturing them
4411269	1986	1988	1	Front-opening brassiere with racer style back
4355641	1986	1987	1	Undergarment with inclusive shoulder pads
4612935	1987	1989	1	Sports bra
4531525	1987	1989	3	Camisole underwire bra garment
4458684	1987	1989	1	Brassiere strap
4418696	1987	1989	1	Brassiere shoulder strap bearing pad
4416284	1987	1988	1	Athletic support brassiere
4638513	1988	1989	1	Brassiere and/or attachment
4633565	1988	1989	2	Closure device for nursing bra
4816005	1989	1991	1	Strap link for brassieres
4795400	1989	1991	2	Dress shield article
4655224	1989	1990	1	Shoulder pad and brassiere strap cushion apparatus
4798557	1990	1991	2	Brassiere strap retainer
4795399	1990	1991	1	Bodywear having integral bra support
4718878	1990	1991	1	Maternity and nursing brassiere with strap variations
4675917	1990	1991	1	Brassiere strap retainer
5171182	1991	1994	1	Swimsuit having control holding power integral in body fabric layer
D322234	1991	1993	1	Exercise brassiere
5060348	1991	1993	1	Shoulder pad and brassiere strap pad apparatus
5024628	1991	1992	1	Backless bust-supporting undergarment
4953233	1991	1992	1	Contoured shoulder pad with closeable pocket for valuables
4945576	1991	1992	1	Brassiere accessory
4879766	1991	1992	1	Brassiere for women
4878879	1991	1992	1	Breast enhancement brassiere
5165113	1992	1994	1	Flexible string-like brassiere retainer
5155869	1992	1994	1	Multi-layer moisture management elastic fabric
5116278	1992	1993	1	Brassiere
5042089	1992	1992	1	Camisole brassiere
5033986	1992	1992	1	Padded straps for garments and method of making same
5662512	1993	1997	1	Brassiere
D383900	1993	1996	1	Cushion strap assembly and method of making same
5297296	1993	1995	1	Attenuating pad
5269720	1993	1995	3	Brassiere
5211598	1993	1995	1	Moisture manging brassiere for sports and general wear
5201078	1993	1995	1	Custom-fit front-opening brassiere
5149293	1993	1993	1	Moisture manging brassiere
5474487	1994	1996	1	Bare shoulder protector
5445858	1994	1996	2	Garment closure
5385502	1994	1996	1	Brassiere blank, brassiere and methods of making same
5359732	1994	1995	1	Brassiere strap bridging and support member
5308278	1994	1995	1	Brassiere strap bridging and support member
5,935,044	1995	1999	1	Method and apparatus for securing brassiere straps
5,685,764	1995	1997	2	Exercise garment with support bra
5662513	1995	1997	2	Postural bra

5614303	1995	1997	2	Orthotic epaulet for alleviating discomfort from brassiere straps
5553468	1995	1997	1	Pad for shoulder straps
5539931	1995	1997	1	Laminated fabric product, brassiere shoulder padand shoe insole pad
5507681	1995	1997	1	Circularly knit brassierehaving knit-in-lift and support panels, and a blank and method for making same
5479791	1995	1996	1	Brassiere and method of making same
5,803,792	1996	1998	2	Anti-slipping brassiere strap bridging and support member
D383888	1996	1997	2	Bra strap holder
D383888	1996	1997	1	Brassiere strap fastenerand method using same
6,213,840	1997	2001	1	Hands-free breast pump supporting bra and system
5,984,762	1997	1999	2	Stretch cushion strap assembly and method and device for making same
5,980,359	1997	1999	2	Bra barrier device
5,975,984	1997	1999	2	Durable padded interchangeable brassiere strap shoulder shield
5,966,740	1997	1999	2	Ladies' asymmetrical support undergarment
5,964,641	1997	1999	3	Brassiere having frontal moisture control
5,946,944	1997	1999	2	Seamless circular knit brassiere and method of making same
5,944,579	1997	1999	2	Non-constricting brassiere
5,914,166	1997	1999	2	Bra-strap securing system
5,911,618	1997	1999	2	Detachable brassiere strap buckle and attachment ring
5,873,767	1997	1999	2	Torso-support garment for women
5,871,388	1997	1999	2	Sports brassiere
5,863,236	1997	1999	2	Size adjustable bra structure
D403,618	1997	1999	2	Shoulder-strap connector for brassieres, lingerie and bathing suits
5,833,594	1997	1998	2	Magnetic brassiere
5,833,515	1997	1998	2	Inflatable breast pads for a brassierie
D398,881	1997	1998	2	Bra strap clip
5,784,765	1997	1998	2	Partial-Release front closure for an uplift brassiere
6,205,585	1998	2001	1	Adjustable garment
6,168,498	1998	2001	1	Brassiere
6,142,852	1998	2000	2	Brassiere comprising at least one elastified cup
6,116,985	1998	2000	1	Sports brassiere
6,102,772	1998	2000	2	Anti-wrinkle brassiere
6,083,079	1998	2000	2	Wireless ergonomic support brassiere
6,074,273	1998	2000	2	Nursing bra
6,068,538	1998	2000	2	Wrap-around sports bra
6,059,634	1998	2000	2	Brassiere-strap slide
5,989,101	1998	1999	3	Bra having cell received therein
5,951,364	1998	1999	2	Brassiere having panels forming straps
5,921,845	1998	1999	2	Brassiere and accessory
5,899,790	1998	1999	3	Scented material container for lingerie and the like
6,309,489	1999	2001	3	Adjustable strap fastener for brassieres and the like and method of making same
6,276,175	1999	2001	1	Seamless torso controlling garment and method of making same
6,233,793	1999	2001	1	Two-step garment closure, epecially as a front closure for a brassiers
6,227,936	1999	2001	2	Hands free pumping and nursing bra
6,200,194	1999	2001	2	Brassiere
6,186,862	1999	2001	2	Brassiere underwire with extended sewing flange
6,165,047	1999	2000	1	Two-in-one brassiere for breast enhancement and support
6,165,045	1999	2000	1	Brassiere for large breasted, athletic women
6,163,937	1999	2000	3	Bra strap converter
6,162,111	1999	2000	2	Article of clothing with built-in bra
6,147,611	1999	2000	3	Personal and portable alarm apparatus
6,146,239	1999	2000	2	Brassiere with shirt sleeve retaining loop
6,132,288	1999	2000	2	Liquid-filled non-flammable brassiere pad
6,125,664	1999	2000	1	Brassiere, brassiere blank and methods of making same
6,123,601	1999	2000	2	Bra arrangement
6,099,382	1999	2000	2	Sports brassiere
6,086,451	1999	2000	2	Decorative brassiere shoulder strap

6,083,080	1999	2000	2	Protective brassiere with local energy absorption
6,059,633	1999	2000		Front-opening garment with built-in front-opening bra
6,056,625	1999	2000	2	Brassiere-strap slide
6,023,785	1999	2000		Size adjustable bra
6,547,636	2000	2003	1	Convertible brassiere
6,540,585	2000	2003	1	Ventilated padded lingerie
6,422,917	2000	2002	1	Therapeutic brassiere
6,375,538	2000	2002	1	Push-in underwire bra
6,321,419	2000	2001	2	Brassiere fastener
6,319,092	2000	2001	1	Nursing bra with removable/replaceable cups
6,318,613	2000	2001	2	Carrying pouch attachable to garments
6,302,761	2000	2001	3	Brassiere
6,296,545	2000	2001	2	Functional brassiere
6,293,844	2000	2001	1	Brassiere
6,287,168	2000	2001	2	Substantially seamless brassiere, and blank and method for making same
6,260,243	2000	2001	1	Reversible press button garment closure
6,260,242	2000	2001	1	Reversible press button garment closure
6,247,996	2000	2001	1	Breast milk pump support harness
6,220,924	2000	2001	1	Brassiere
6,198,204	2000	2001	3	Piezoelectrically controlled active wear
6,176,761	2000	2001	1	Sports bra with storage pouch
D433,965	2000	2000	2	Reversible press button closure for shoulder strap or back band of brassieres
6,135,853	2000	2000	2	Bra strap concealer apparatus
6,792,620	2001	2004	1	Garment secured by lock and garment closure system and method
6,685,534	2001	2004	1	Adjustable circular knit bra with stabilizing areas and methods of making the same
6,557,232	2001	2003	2	Method of making brassiere fastener by injection molding on fabric tape
6,550,067	2001	2003	1	Nursing brassiere garment
6,544,100	2001	2003	2	Push-up bra pad
6,517,410	2001	2003	2	Sports bra with floating storage pouch
D465,899	2001	2002	1	Brassiere strap pad
D465,637	2001	2002	1	Brassiere having a clear back strap
6,439,959	2001	2002	2	Wireless support for brassiere
6,425,800	2001	2002	2	Seamless brassiere
6,402,586	2001	2002	1	Post-surgical bra
6,394,879	2001	2002	1	Postpartum brassiere
6,390,884	2001	2002	2	Apparatus and method for enhancing a woman's cleavage
6,381,752	2001	2002	2	Bra with selectively configurable straps using a stiffening attachment
6,364,741	2001	2002	2	Disposable nursing bra
6,346,027	2001	2002	2	Nursing bra device
6,846,219	2002	2005	1	Rigid frame brassiere with soft cup
6,832,945	2002	2004	1	Bra structure having rigid under-arm support members
6,827,628	2002	2004	2	Non-slip shoulder strap for a brassiere
6,824,444	2002	2004	1	Brassieres
6,755,717	2002	2004		Brassiere, halter or bra garment improved with laterally attached, adjustable elastic bands for inertially restraining breasts
6,708,530	2002	2004	1	Single-layer/double-layer cushion cup brassiere with terry loop stitch construction
6,645,041	2002	2003	1	Brassiere, mainly for use when nursing
6,634,923	2002	2003	2	Shoulder strap for a brassiere
6,575,811	2002	2003	2	Zip wire brassiere
6,855,029	2003	2005	1	Stretchable nursing tank top with invisible breast support
6,854,132	2003	2005	1	Nursing garment
6,839,908	2003	2005	1	Maternity and/or nursing breast support for fashionable woman's apparel
6,817,214	2003	2004	1	Selectively folded two-ply brassiere and blank for making the same
6,805,610	2003	2004	1	Brassiere
6,786,798	2003	2004	4	Antimicrobial bra
D491,101	2003	2004	1	Shoulder-strap clip for a brassiere
D486,294	2003	2004	1	Bra strap securing device

Level of Innovation	1	2	3	4	5
	Apparent / Conventional Solution 32% (1964-1974) *(trivial non-inventive inv.)*	**Small Invention Inside Paradigm** 45% (1964-1974) *(common invention)*	**Substantial Invention Inside Technology** 18% (1964-1974) ***(average, solid invention)***	**Invention Outside Technology** 4% (1964 - 1974) ***(macro inventions)***	**Discovery** 1% (1964 – 1974) *(major invention & new science)*
Field of Solution	Problem & solution methods **within one professional field**		Problem & solution methods belong to **same technology**	Other science field, **outside technology** involving completely different principle	**Outside** contemporary **scientific knowledge**
Solution Mechanism	**Obvious** (undisguised) solutions from a few clear options	Solution **not obvious** to untrained person – possible give-up	Technology of other industries **beyond accepted ideas & principles** ⇒ paradigm shift in industry	**New generation of design** using science not technology	**New phenomenon** discovered & applied to inventive problem
Characteristics of System	**Existing system** not substantially changed	**Existing system** slightly changed	**Existing system** essentially improved	Synthesis of **a new technical system**	**New technical systems**, industries & design products
Effects / principles leading to solution	Enhanced features - **good engineering**	**New features** ⇒ improvements, but obvious compromise	Combination of several physical effects, 'tricky' methods, **ingenious use of well-known physical phenomena**	**Physical effects & phenomena previously little known**	Solution methods **beyond the scope of modern science**
Existence of Contradictions	Contradictions **not identified & resolved**	System inherent contradiction **reduced, but not eliminated**	Contradiction **resolved within existing system**, often through introduction of entirely new element	Contradictions **eliminated since non-existent** in NEW system	**No** contradictions
Examples	Increasing wall thickness to create greater insulation	Adjustable steering columns increases range of body types able to drive comfortably	Replacing standard transmission of a car with an automatic transmission	Using material with thermal memory for key rings that open in hot water	Laser, Transistor

[1] Yuri Salamatov. "TRIZ: The Right Solution at the Right Time" Insytec B.V., The Netherlands, 1999, ISBN 90-804680-1-0

[2] John Terninko, Alla Zusman, Boris Zlotin. "STEP-by-STEP TRIZ: Creative Innovative Solution Concepts" Responsible Management Inc., Nottingham, New Hampshire, USA, 1996